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48TH CONGRESS, 1st Session. } HOUSE OF REPRESENTATIVES. { Ex. Doc. 1, Part 2.

REPORT

OF THE

SECRETARY OF WAR;

BEING PART OF

THE MESSAGE AND DOCUMENTS

COMMUNICATED TO THE

TWO HOUSES OF CONGRESS

AT THE

BEGINNING OF THE FIRST SESSION OF THE FORTY-EIGHTH CONGRESS.

IN FOUR VOLUMES.

VOLUME II.

PART 1.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1883

ANNUAL REPORT

OF THE

CHIEF OF ENGINEERS,

UNITED STATES ARMY.

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REPORT

OF

THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., October 13, 1883.

SIR: I have the honor to present for your information the following report upon the duties and operations of the Engineer Department for the fiscal year ending June 30, 1883:

OFFICERS OF THE CORPS OF ENGINEERS.

The number of officers holding commissions in the Corps of Engineers, United States Army, at the end of the fiscal year was 103 on the active list and 9 on the retired list, the latter, however, under the law of January 21, 1870, not being available for duty.

Since the last annual report the Corps has lost, by death, resignation, and retirement, seven of its officers: Lieut. Col. Gouverneur K. Warren, who died at Newport, R. I., August 8, 1882; Maj. Franklin Harwood, who died at Boston, Mass., March 26, 1883; Maj. James W. Cuyler, who died at Philadelphia, Pa., April 16, 1883; Capt. Benjamin D. Greene, who resigned to date December 31, 1882; Second Lieut. Edward O. Brown, who resigned to date July 1, 1882; and Col. Z. B. Tower, who was retired January 10, 1883, and Col. George Thom, who was retired February 20, 1883, under provisions of section 1 of the act of Congress approved June 30, 1882.

There have been added to the Corps, by transfer to date July 1, 1882, two second lieutenants, one each from the Fifth Artillery and Fourth Cavalry, and by promotion of graduates of the Military Academy three second lieutenants. The commissions of the latter date from June 13, 1883, but they did not become available for duty until after the close of the fiscal year, and are therefore not included in the strength of the Corps.

On the 30th of June, 1883, the officers were distributed as follows:

Office Chief of Engineers, including the Chief	4
Fortifications and river and harbor works	17
Fortifications, river and harbor works, and The Mississippi River Commission	1
Fortifications, river and harbor works, and Board of Engineers	2
Fortifications, river and harbor works, and Yorktown Monument	1
Fortifications, river and harbor works, and light-house duty	2
Fortifications, light-house duty, and examinations at South Pass	1
Fortifications, Board of Engineers, Battalion of Engineers, and Joint Gun Foundry Board	1
River and harbor works	23
River and harbor works and Board of Engineers	1
River and harbor works, Mississippi River Commission, and light-house duty	1

River and harbor works, and improvement of Hot Springs Creek under direction of the Secretary of the Interior	1
River and harbor works and light-house duty	1
Board of Engineers and The Mississippi River Commission	1
Construction of building for State, War, and Navy Departments, Washington National Monument, improvements over grave of Thomas Jefferson, and monument at Newburg, N. Y	1
Washington Aqueduct and Government of the District of Columbia	2
Battalion of Engineers	14
Leave of absence	4
Detached, on duty with the General of the Army, generals commanding divisions and departments, Light-House Establishment, Military Academy, Board of Commissioners of District of Columbia, The Mississippi River Commission, under State Department on boundary line between United States and Mexico, and with Fourth Cavalry	25
	103

The officers detached were on duty as follows:

Col. William F. Raynolds, engineer fourth light-house district	1
Col. James C. Duane, engineer third light-house district	1
Lieut. Col. Orlando M. Poe, on staff of the General of the Army	1
Maj. Orville E. Babcock, engineer fifth and sixth light-house districts	1
Maj. David P. Heap, engineer secretary to Light-House Board	1
Maj. William A. Jones, on staff of Major-General Commanding Division of the Pacific	1
Capt. William R. Livermore, on staff of Commanding General, Department of Texas	1
Capt. William S. Stanton and Lieut. William M. Black, on duty with Company E, Battalion of Engineers, and at Military Academy	2
Capt. James F. Gregory, on staff of Lieutenant-General commanding Division of the Missouri	1
Capt. Charles E. L. B. Davis, engineer tenth and eleventh light-house districts	1
Capt. Clinton B. Sears, executive officer of The Mississippi River Commission, and secretary and assistant to committee on construction	1
Capt. Albert H. Payson, engineer twelfth light-house district	1
Capt. Francis V. Greene, assistant to Engineer Commissioner, District of Columbia	1
Lieuts. Eric Bergland, Willard Young, and Solomon W. Roessler, on duty at the Military Academy	3
Lieut. Henry S. Taber, on staff of Commanding General, Department of Dakota.	1
Lieut. Thomas W. Symons, on duty under Department of State in connection with boundary line between the United States and Mexico	1
Lieut. Smith S. Leach, secretary and disbursing officer of The Mississippi River Commission	1
Lieut. Dan C. Kingman, on staff of Commanding General, Department of the Platte	1
Lieut. Gastav J. Fiebeger, on staff of Commanding General, Department of Arizona	1
Lieut. Oberlin M. Carter, on staff of Commanding General, Department of the Missouri	1
Lieut. George W. Goethals, on staff of Commanding General, Department of the Columbia	1
Lieut. Eugene J. Spencer, on duty with Fourth Cavalry	1
	25

SEA-COAST AND LAKE-FRONTIER DEFENSES.

During the year operations have been restricted to those necessary for the preservation and repair of the existing works.

No appropriations for new works nor for the modification of existing ones have been made during the past eight years, and to-day the permanent fortifications of the country are in the incomplete condition in which they were left when operations were suspended in 1876, and are rapidly deteriorating for lack of funds to complete them.

This subject has been so fully discussed in former reports, especially those for the years 1880 and 1881, that it seems quite unnecessary to do

more now than to refer to them; and the more so as the views of the Board of Engineers for Fortifications given on page 51 and following, so fully cover the entire matter of our defensive system. To those views, and to the annual reports from this office above alluded to, I beg most earnestly to invite your attention and that of Congress, in the hope that their careful consideration may secure the means, by liberal appropriations, for that improvement of our defensive system which is so imperatively demanded by the vast interests it is designed to protect.

FORTIFICATIONS.

DEFENSES OF THE NORTHERN FRONTIER.

Fort Wayne, Michigan, in charge of Maj. Walter McFarland, Corps of Engineers, until May 1, 1883; *since that date in charge of Lieut. Col. Henry M. Robert, Corps of Engineers.*—This work is situated on the west bank of the Detroit River, within the limits of the city of Detroit, and commands the passage of the Detroit River. It is a square bastioned work, commenced in 1841, with a brick and concrete scarp replacing the original timbered scarp, detached parapet on the curtains and faces, an unfinished demilune on the water front, and unfinished water batteries on the up and down stream sides.

The construction of this fort in its present form was commenced in 1862, and completed in 1871; its repair was begun in 1882, and will be completed during the present fiscal year by an aggregate expenditure of $19,114.82.

The repair of the scarp wall, which was in progress by hired labor during the last part of the preceding fiscal year, was continued under a contract with John Ratigan, dated June 28, 1882. The work provided for and done under this contract consisted of setting four angle stones of about two tons weight each in the coping of the scarp-wall; pointing and calking the joints of the brick scarp revetment of the right face and flank of the north bastion, and 59 linear feet of the adjoining northeast curtain, aggregating 329 linear feet of scarp-wall, 22 feet high. The balance of funds available were applied to clearing, pointing, and calking the joints on 51.4 linear feet of the northeast curtain. The contract prices for this work were as follows:

For setting angle stones and brick adjoining, $35 each.

For pointing and calking joints which had been cleared by hired labor, $1.17 per square yard.

For clearing, pointing, and calking joints, $1.50 per square yard.

Upon the expenditure of available funds the work was stopped and an estimate of $10,000 for its completion was submitted.

Under an allotment of $10,000, a contract dated June 1, 1883, was entered into with Messrs. Rogers & Traves for labor on the work of repairs at the following rates:

Clearing and pointing scarp-walls, at $1.15 per square yard.

Clearing and pointing casemate-walls, at $1.50 per square yard.

Cutting out and replacing damaged brick, at $40 per thousand, the United States furnishing cement, sand, and brick, and the use of tools.

Work was begun on June 26, 1883, and at the close of the fiscal year the joints over 550 square yards of scarp-wall had been cleared, 87 square yards pointed and calked, and 320 defective brick removed, and the material for the balance of the repairs had been received.

The work now in progress will probably be completed by October,

DEFENSES OF THE NORTHERN FRONTIER—Continued.

1883, and will place the work in good condition, probably requiring nothing more to be done for several years to come.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

Fort Porter, Black Rock, near Buffalo, New York, in charge of Maj. Walter McFarland, Corps of Engineers, until May 1, 1883; *since that date in charge of Lieut. Col. Henry M. Robert, Corps of Engineers.*—This work, commenced in 1842, is situated on the Niagara River, within the limits of the city of Buffalo, and consists of a square stone tower or keep, in ruins, surrounded by a square barbette battery.

The keep was nearly destroyed by fire many years ago, and the entire work is, in its present condition, useless for offense or defense.

By joint resolution of Congress, approved July 11, 1870, published in General Orders 93, July 22, 1870, permission was granted to the city of Buffalo, through its park commissioners, "to improve and beautify the grounds known as Fort Porter, situated in said city, and belonging to the United States, in connection with a public park to be laid out on land adjoining the said grounds, the plans for the same to be approved by the Secretary of War: *Provided*, That this resolution shall not be construed to pass any title in the said grounds, but that the ownership and control of said grounds shall remain entirely in the United States, and shall be subject to such changes and uses for military purposes as the Secretary of War may direct."

Under this authority the larger part of the United States grounds at Fort Porter have been handsomely laid out and improved by the authorities of the city of Buffalo.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

Fort Niagara, mouth of Niagara River, New York, in charge of Maj. Walter McFarland, Corps of Engineers, until May 1, 1883; *since that date in charge of Lieut. Col. Henry M. Robert, Corps of Engineers.*—This work, commenced in 1839, is situated at the mouth of the Niagara River, on the south shore of Lake Ontario, about 40 miles from and east of its western extremity.

It is an irregular work, having one strong land front runing nearly north and south, extending from Lake Ontario at its northern extremity nearly to the Niagara River at its southern extremity. This front is half bastioned, with detached parapet, demilune, and four casemates for howitzers in each flank. The rest of the *tracé* is irregular, following the general course of the river and of the lake shore.

The work contains two masonry block-houses, built by the French about 1757, and other buildings begun by the French and finished by the English after its capture by them during the French and Indian war.

No money has been expended on this work since 1871, except for slight repairs.

The work has no armament and no gun platforms, excepting a timber one in the south bastion for a $4\frac{1}{2}$-inch siege gun.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

Fort Ontario, mouth of Oswego River, New York, in charge of Maj. Walter McFarland, Corps of Engineers, until May 1, 1883; *since that date in charge of Lieut. Col. Henry M. Robert, Corps of Engineers.*—This work, commenced in 1839, is situated at the mouth of the Oswego River,

on its east bank, and on the south shore of Lake Ontario, and lies within the limits of the city of Oswego.

It is a bastioned work, pentagonal in shape, with one front facing the lake, one facing the river, and three land fronts, the middle one of which has a demilune. The scarp, which is unfinished, is of masonry; the counter-scarp is revetted with timber. The sallyport passes through the curtain of front 4, which is that one of the three land fronts which lies nearest the river, with bastion D on its left, and bastion E on its right. The flanks which cover this entrance are furnished with three casemates each for howitzers. The faces adjacent to these flanks are partly furnished with scarp galleries loop-holed for musketry. All the other flanks are to be provided with scarp galleries loop-holed for musketry; but five of them are not yet built. No money, except for slight repairs, has been expended upon this work since 1872, and its condition is now essentially the same as it was shown to be in the annual report for that year, excepting that some minor repairs have been made, and tight board fences, 7 feet high and flush with the face of the scarp walls, have been constructed at and over those points where the scarp wall is unfinished, and so low as to admit of easy access to the interior of the work from the ditch. The work has no armament, and no preparations for any except the flank casemates on front 4. It has no garrison, and has been transferred to the Engineer Department for repairs, under instructions from the General of the Army, concurred in by the Secretary of War.

The Board of Engineers for Fortifications recommend that this work be left as it is for the present.

Nothing has been done at this work during the year except minor repairs.

The New York, Ontario and Western Railroad (formerly the "Midland") received license from the Secretary of War to cross the United States reservation on which Fort Ontario is located, and during the year, under the provisions of the license, have laid three tracks across the reservation a distance of about 1,500 feet, and about 400 feet within its south boundary.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

Fort Montgomery, outlet to Lake Champlain, New York, in charge of Maj. Walter McFarland, Corps of Engineers, until May 1, 1883; *since that date in charge of Lieut. Col. Henry M. Robert, Corps of Engineers.*—This casemated work, commenced in 1841, occupies a strategic point of great importance, and commands the entrance to Lake Champlain from the Richelieu or Saint John River.

The rebuilding of this work in its present form was accomplished in 1876, and completes the work, except the interior fittings of a part of the casemates intended for quarters, and also parts of Bastions A and E, where temporary wooden floors have been built for the second tier of casemates.

There have been no operations at this work during the past fiscal year.

By the formation of ice during the severe winters the methods of drainage, as now provided, become inoperative, and consequently the work is subjected to the destructive action of frost and water, rendering almost useless any work of repointing casemate arches or embrasures.

The separation of the scarp wall from the casemates, referred to in

DEFENSES OF THE NORTHERN FRONTIER—Continued.

the annual report for last year, seems to have increased, the interval in some cases being 4 inches.

A careful consideration of the probable causes of this separation will have to be made before any intelligent action can be taken to remedy the evil.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

DEFENSES OF THE PENOBSCOT.

Fort Knox, Bucksport, Penobscot River, Maine, in charge of Col. C. E. Blunt, Corps of Engineers.—This work, situated at the narrows of the Penobscot River, furnishes a defense for the city of Bangor, 18 miles above, and other towns bordering the river, and renders it available as a secure harbor of refuge for the shipping of the extensive eastern coast.

The work, which was commenced in 1843, consists of a casemated main work and exterior earthen batteries, both requiring extensive modifications. It remains in an unchanged condition, no operations having been carried on during the fiscal year except for the necessary care and preservation of the property.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

DEFENSES OF THE KENNEBEC.

Fort Popham, Kennebec River, Maine, in charge of Col. C. E. Blunt, Corps of Engineers.—This casemated work, commenced in 1857, defends the entrance, through the mouth of the Kennebec River, to the rich valley of this river, the cities of Bath and Augusta, and the United States arsenal at the latter place.

The work, which requires extensive modifications, remains in an unfinished condition, no operations having been carried on during the fiscal year, except for the necessary care and preservation of the property.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

DEFENSES OF PORTLAND.

Fort Gorges, Portland Harbor, Maine, in charge of Col. C. E. Blunt, Corps of Engineers.—This casemated work, commenced in 1857, is one of the series of forts designed to defend the harbor, and channels leading into the harbor, of the important strategic position occupied by the city of Portland. Its construction was suspended for want of funds in 1876, and the work is in an incomplete condition.

The long suspension of operations causing deterioration, the working plant must be renewed when work is resumed.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.
Appropriation asked for next fiscal year..... $12,000 00

Fort Preble, Portland Harbor, Maine, in charge of Col. C. E. Blunt, Corps of Engineers.—This work occupies such a position that three-

DEFENSES OF PORTLAND—Continued.

fourths of its guns command the two principal channels entering the harbor of Portland.

The original work on this site was built in 1808. The new earthen batteries with parados and traverse magazines, which have been partially executed, are in an incomplete condition and suffering from exposure.

The condition of the work is unchanged from the close of the last fiscal year.

The derricks and other working machinery have so deteriorated during the long suspension that considerable expense must be incurred in their renewal.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year..... $35,000 00

Fort Scammel, Portland Harbor, Maine, in charge of Col. C. E. Blunt, Corps of Engineers.—This work, commenced in 1841, occupies a very important position in the harbor, and commands four of the channels leading into it. It is an inclosed work with detached masonry bastions and heavy earthen batteries.

Plans for its modification and for additional earthen batteries have been prepared by the Board of Engineers for Fortifications and approved by the Secretary of War. They are only partially executed, and the work is in an incomplete condition.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year..... $100,000 00

Battery on Portland Head, Portland Harbor, Maine, in charge of Col. C. E. Blunt, Corps of Engineers.—This modern earthwork, commenced in 1873, will, when completed, cover by its guns all the approaches to the main channel leading into the harbor, and will prevent by its fire an enemy's fleet from taking up, unopposed, a position behind Bang's Island from which to bombard Portland or shell the shipping in the harbor.

This work remains in the incomplete condition reported at the close of the last fiscal year.

For the construction of the operating-room and gallery for torpedo-cables and for continuing work on the battery itself, an appropriation of $50,000 is asked.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year..... $50,000 00

Batteries on Cow Island, approaches to the harbor of Portland, Maine.—The object of these earthworks is, with batteries designed to be placed on Great Hog Island, to prevent an enemy's occupation of Casco Bay and to guard the passage from it to Portland Harbor.

Plans for the construction of batteries for the heaviest guns on this island have been prepared by the Board of Engineers for Fortifications,

DEFENSES OF PORTLAND—Continued.

and it is proposed to commence work upon them as soon as funds are available.

No appropriation for their construction has yet been made.
Appropriation asked for next fiscal year..... $50,000 00

Batteries on Great Hog Island, approaches to the harbor of Portland, Maine.—The object of these earthworks is, with batteries designed to be placed on Cow Island, to prevent an enemy's occupation of Casco Bay and to guard the passages from it to Portland Harbor.

Plans for the construction of batteries for the heaviest guns on this island have been prepared by the Board of Engineers for Fortifications, and it is proposed to commence work upon them as soon as funds are available.

No appropriation for their construction has yet been made.
Appropriation asked for next fiscal year..... $50,000 00

DEFENSES OF PORTSMOUTH AND THE NAVY-YARD AT KITTERY.

Fort McClary, Portsmouth Harbor, New Hampshire, in charge of Col. C. E. Blunt, Corps of Engineers.—This work, together with Fort Constitution, opposite, forms the inner line of defense to the mouth of the Piscataqua River and to the navy-yard at Kittery, Me.

The original fort was commenced early in the present century. An inclosed barbette work was commenced in 1863, but has not been completed.

The work remains the same as at the date of last report, no operations having been carried on except for the necessary care and preservation of the property.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

Fort Constitution, Portsmouth Harbor, New Hampshire, in charge of Col. C. E. Blunt, Corps of Engineers.—This work, together with Fort McClary, opposite, forms the inner line of defense to the mouth of the Piscataqua River and to the navy-yard at Kittery, Me.

Extensive modifications are required for the casemated work at this place before proceeding with its construction. Plans for an exterior earthen battery for heavy rifled guns have been approved by the Secretary of War, but it has not yet been commenced.

The condition of this work has remained unchanged since the date of the last Annual Report, no operations having been carried on except for the necessary care and preservation of the property.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

Battery on Gerrish's Island, Portsmouth Harbor, New Hampshire, in charge of Col. C. E. Blunt, Corps of Engineers.—This earthwork, with the one opposite on Jerry's Point, forms the outer line of defense to Portsmouth Harbor and to the navy-yard at Kittery, Me. It was commenced in 1873.

The work remains in the same incomplete condition reported at the close of the last fiscal year.

Plans for the completion of this work have been prepared by the Board of Engineers for Fortifications and approved by the Secretary of War, but are only partially executed.

DEFENSES OF PORTSMOUTH AND THE NAVY-YARD AT KITTERY—Continued.

An appropriation is asked for constructing the operating-room and gallery for torpedo-cables and continuing work on the battery proper.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year $36,000 00

Battery on Jerry's Point, Portsmouth Harbor, New Hampshire, in charge of Col. C. E. Blunt, Corps of Engineers.—This earthwork is on the western side of the entrance to the harbor of Portsmouth, New Hampshire, and with the battery at Gerrish's Island, on the opposite side of the entrance, forms the outer line of defense to that harbor and to the navy-yard at Kittery, Me. It was commenced in 1873.

Plans for the completion of this work have been prepared by the Board of Engineers for Fortifications and approved by the Secretary of War, but are only partially executed.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year $50,000 00

DEFENSES OF BOSTON AND THE NAVY-YARD AT CHARLESTOWN.

Fort Warren, Boston Harbor, Massachusetts, in charge of Col. C. E. Blunt, Corps of Engineers, until January 19, 1883; *since that date in charge of Maj. Charles W. Raymond, Corps of Engineers.*—This important fort, on George's Island, is for the defense of the main channel of entrance to Boston Harbor, and commands the anchorage of Nantasket Roads.

The present work was commenced in 1833, and consists of a full bastioned casemate *enceinte*, protected on the fronts exposed to breaching batteries from adjacent islands by an earthen cover face and a ravelin, both of which are in part mounted with batteries *en barbette*.

For some years past, owing to inadequate appropriations, operations have been limited to the immediately necessary repair and preservation of the work and its property.

During the fiscal year ending June 30, 1883, repairs have been made to the hospital drain, and spandrel drains, and storage cisterns of Front III; also the unfinished masonry of Bastions B and E. The repainting of 15-inch gun platforms of the ravelin upper battery, and Bastions A and E. Where necessary the plastering of the quarters of Front III have been repaired; also the slate revetment of the service magazine in the ravelin battery. Some repairs have been made to engineer buildings, and about 450 square yards of earth slopes have been regraded and resodded.

Operations for the current fiscal year will be of a like character to those of 1882–'83, for the same reason.

To complete the work in accordance with existing plans it is estimated that $185,000 will be required.

An appropriation is asked for the modification and completion of the

DEFENSES OF BOSTON AND THE NAVY-YARD AT CHARLESTOWN—Continued.

work according to plans prepared by the Board of Engineers for Fortifications.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year..... $100,000 00

Battery at Long Island Head, Boston Harbor, Massachusetts, in charge of Col. C. E. Blunt, Corps of Engineers, until January 19, 1883; *since that date in charge of Maj. Charles W. Raymond, Corps of Engineers.*—This earthwork occupies an important position in the outer line of defense for Boston Harbor, and its guns bear on all the channels of entrance.

It was commenced in 1871, and was designed for the reception of the heaviest modern ordnance. Nothing has been done in construction since the fiscal year 1875–'76 for want of appropriations, and the work, the plans of which have been prepared by the Board of Engineers for Fortifications and approved by the Secretary of War, is in an unfinished condition.

During the fiscal year ending June 30, 1883, operations have been limited to absolutely necessary repairs, and consist of the following: About 150 square yards of earth-slopes have been regraded and resodded. The cesspools of the terrepleins of the batteries, and those of the main drain under the cover-face have been cleaned out and repaired, and some minor repairs made to the ventilators of the service magazines, and engineer building.

During the current fiscal year, operations will be of a like character, for similar reasons.

To complete the work in accordance with existing plans it is estimated that $90,000 will be required.

The condition of the work is essentially unaltered from that at the date of the last Annual Report.

Appropriation asked for the next fiscal year..... $50,000 00

Fort Winthrop, Boston Harbor, Massachusetts, in charge of Col. C. E. Blunt, Corps of Engineers, until January 19, 1883; *since that date in charge of Maj. Charles W. Raymond, Corps of Engineers.*—This work, on Governor's Island, is one of the works forming the inner line of defense for Boston Harbor.

The present work was commenced in 1844, and consists of a central casemated keep and exterior earthen batteries. The mortar battery is intended for six or twelve mortars. All of the gun platforms of this fort, with the exception of the eleven in the exterior tower battery, are now ready for their armament. The plans of this fort have been modified by the Board of Engineers for Fortifications for the reception of modern ordnance, and they have been partially executed.

No active operations have been in progress, owing to the want of funds. The allotment from the general appropriation for the preservation and repair of fortifications for this work was expended in the general care and oversight of the property, in repairing and resodding about 1,100 square yards of earth-slopes, principally at the counterscarp of the tower ditch, and the south battery, in repairs to engineer buildings and drains of different batteries.

DEFENSES OF BOSTON AND THE NAVY-YARD AT CHARLESTOWN—Continued.

Sea-walls are required for the protection of the sites of the east and south batteries. For the one planned for the east battery $30,000 will probably be sufficient, but the last year has shown that the south battery site requires still further protection, and will cost at least $50,000.

The estimated amount required to complete the work in occordance with present plans is as follows:

Tower exterior battery	$75,000 00
South battery	25,000 00
East battery, sea-wall	30,000 00
South battery, sea-wall	50,000 00
Total	180,000 00

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for the next fiscal year.....$100,000 00

Fort Independence, Boston Harbor, Massachusetts, in charge of Col. C. E. Blunt, Corps of Engineers, until January 19, 1883; *since that date in charge of Maj. Charles W. Raymond, Corps of Engineers.*—This casemated work, situated on Castle Island, is one of the inner line of defenses for the harbor of Boston. The present work was commenced in 1833.

During the entire year active operations have again been suspended from a want of sufficient funds, but the work is in essentially as good order as at the date of my last report.

An allotment from the general appropriation for the repair and preservation of fortifications was made and expended in the repairing of the earth-slopes of the parapet, in cleaning out drains, and in repairing storm doors of traverse magazines.

The plans of this work have been modified by the Board of Engineers for Fortifications for the reception of modern heavy ordnance, and they have been partially executed, but no work has been done since the fiscal year 1875–'76, on account of want of appropriations.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for the next fiscal year..... $50,000 00

DEFENSES OF NEW BEDFORD.

Fort at Clark's Point, New Bedford Harbor, Massachusetts, in charge of Lieut. Col. G. K. Warren, Corps of Engineers, until August 8, 1882; *temporarily in charge of Maj. J. W. Barlow, Corps of Engineers, until November* 24, 1882; *since that date in charge of Lieut. Col. George H. Elliot, Corps of Engineers.*—This casemated work, commenced in 1857, commands the entrance of the harbor of New Bedford.

Plans for new earthen batteries for modern heavy guns have been completed by the Board of Engineers for Fortifications, and work can be begun as soon as money is appropriated.

DEFENSES OF NEW BEDFORD—Continued.

The appropriation asked for is for commencing the construction of barbette earthen batteries for modern ordnance, in accordance with the plans approved by the Secretary of War.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for the next fiscal year $30,000 00

DEFENSES OF NARRAGANSETT BAY.

Fort Adams, Newport Harbor, Rhode Island, in charge of Lieut. Col. G. K. Warren, Corps of Engineers, until August 8, 1882; *temporarily in charge of Maj. J. W. Barlow, Corps of Engineers, until November* 24, 1882; *since that date in charge of Lieut. Col. George H. Elliot, Corps of Engineers.*—This large and important work, commenced in 1824, defends the harbor and city of Newport, and commands the principal passage to Narragansett Bay, one of the best roadsteads on the coast.

The preparatory work for the construction of the new exterior earthen battery for modern ordnance (such as opening roads, draining the grounds, &c.) having been all completed, rapid progress can be made in construction when the necessary funds are appropriated. This important battery at the end of the fiscal year 1875–'76 had but recently been commenced in accordance with plans approved by the Secretary of War, and no work has been done since that year for want of appropriations.

With an allotment from the appropriation for protection, preservation, and repair of fortifications, approved May 19, 1882, a retaining-wall has been built in the inner side of the basin of the permanent wharf, and the head of the east pier of this wharf has been completed.

The covering of casemates, occupied as quarters by the garrison, with concrete, has been continued over the south and north fronts. All of the casemates occupied as quarters, except two on the south face recently fitted up, are now covered with concrete.

As much difficulty has been had at Fort Adams, and at other of our old fortifications, in preventing leaks from the terreplein over casemates used as quarters, the mode recently used with entire success at Fort Adams is thus described: The concrete, composed of one part of Portland cement and four parts of a mixture of coarse and fine gravel and sand, was laid 3 inches thick upon the brick pavement of the terreplein, taking care to have as few joints as practicable. The concrete was carried well up under the earthen banquettes, which were carefully resodded, and also over the *entire width of the parade coping.* In earlier trials, when the concrete was carried only a few inches over the coping, it was found that the unequal expansion and contraction by varying temperatures, acting on the stone coping and on the concrete surface behind it, invariably made a break in the concrete over the joint between the coping and the brick pavement underneath. By covering the entire top surface with concrete this difficulty is not experienced.

Complaint having been made of a want of ventilation and light in the casemates used as quarters on the land front, with the authority of the Chief of Engineers, the brick cheeks of the embrasures and loop-holes of 25 of the casemates on that front were removed, giving much satisfaction to the garrison. The increase in area of the embrasure

DEFENSES OF NARRAGANSETT BAY—Continued.

openings was from $5\frac{2}{3}$ square feet to 18 square feet, and of the loop-hole openings from 1 square foot to 4 square feet.

The engineer stable has been reshingled and the carpenter shop and cement storehouse have been painted. The south side of engineer wharf has been piled and capped, and the stairs leading from the parade to the lower tier of casemates on west front have been rebuilt.

The appropriation asked is for continuing the construction of barbette earthen batteries for modern ordnance, in accordance with plans approved by the Secretary of War.

No appropriation having been made, no work was done during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year $40,000 00

Defenses of Dutch Island, western entrance to Narragansett Bay, Rhode Island, in charge of Lieut. Col. G. K. Warren, Corps of Engineers, until August 8, 1882; temporarily in charge of Maj. J. W. Barlow, Corps of Engineers, until November 24, 1882; since that date in charge of Lieut. Col. George H. Elliot, Corps of Engineers.—These earthworks, commenced in 1863, command the western passages to Narragansett Bay.

Nothing has been done here since the fiscal year of 1875–76.

The appropriation asked is for continuing the construction of barbette earthen batteries for modern ordnance, in accordance with plans approved by the Secretary of War.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year $30,000 00

DEFENSES OF NEW LONDON HARBOR AND NAVY-YARD.

Fort Trumbull, New London Harbor, Connecticut, in charge of Maj. J. W. Barlow, Corps of Engineers, until May 23, 1883; since that date in charge of Maj. Walter McFarland, Corps of Engineers.—This casemated work, commenced in 1838, is situated on a promontory on the west shore of New London Harbor, about 2 miles from Long Island Sound. It is a pentagonal structure with four bastions in which and in three fronts overlooking the harbor are positions for fourteen casemate guns and eight flank howitzers; above these is a terreplein with twenty-four platforms for barbette guns. The sallyport is in the north face and is covered by a place of arms with positions for six guns *en barbette*. In addition, there were north and south exterior batteries for mounting eleven and eight guns, respectively, all of modern caliber.

A plan for rebuilding both exterior batteries to mount 15-inch guns in single position was submitted by the Board of Engineers for Fortifications, in accordance with which the north battery was rebuilt and is now complete and ready for mounting guns, except placing the traverse irons and pintles; these are on hand and could be set on short notice. No money has been available for continuing the plans for the south battery.

With an allotment from the general appropriation for the preservation and repair of fortifications, a sea-wall extending north from the

DEFENSES OF NEW LONDON HARBOR AND NAVY-YARD—Continued.

wharf was begun, and a wooden shed for the protection of Government property was built.

The estimate for rebuilding the south exterior battery is $40,000.

Fort Trumbull is garrisoned by two companies of the First Artillery.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year..... $40,000 00

Fort Griswold, New London Harbor, Connecticut, in charge of Maj. J. W. Barlow, Corps of Engineers, until May 23, 1883; *since that date in charge of Maj. Walter McFarland, Corps of Engineers.*—This is a barbette earthwork battery, on the east side of New London Harbor and opposite the city. It was begun in 1840, and was designed as an auxiliary to Fort Trumbull in the defense of the harbor. It is built on the hillside, and from its elevation of 80 feet above tide-water overlooks every part of the harbor.

The plans for modifying the defenses of New London Harbor, submitted and approved in 1874, included the rebuilding of this battery to receive eight 15-inch guns in double position, at an estimated cost of $47,712. This fort is not garrisoned.

No work has been done during the past fiscal year.

No appropriation was made for the fiscal year ending June 30, 1884.

Appropriation asked for next fiscal year..... $48,000 00

DEFENSES OF NEW HAVEN.

Fort Hale, New Haven Harbor, Connecticut, in charge of Maj. J. W. Barlow, Corps of Engineers, until May 23, 1883; *since that date in charge of Maj. Walter McFarland, Corps of Engineers.*—This is an earthwork structure, built near the close of the late war. It is situated on a point on the east side of the harbor, about 2 miles below the city and 2 miles above Long Island Sound. It was built as a temporary work, and is rapidly going to ruin; it cannot be made into a permanent work without rebuilding completely. The position is an advantageous one in many respects for the erection of permanent works for the defense of the city, but no project has yet been submitted with this view.

Fort Hale has been dismantled since March, 1872.

No work was done during the past year.

No appropriation was made for the fiscal year ending June 30, 1884.

No appropriation asked for next fiscal year.

DEFENSES OF NEW YORK AND THE NAVY-YARD AT BROOKLYN.

Fort Schuyler, East River, New York, in charge of Lieut. Col. H. L. Abbot, Corps of Engineers.—This is an important work for the defense of the entrance to the harbor of New York City through the East River. It was commenced in 1833.

No progress has been made during the year, the available funds having been only sufficient to care for the public property; to finish the repairs of an engineer building formerly used as a boarding-house for our employés; to repair the eastern slopes of parados in rear of the 10-gun

DEFENSES OF NEW YORK AND THE NAVY-YARD AT BROOKLYN—Continued.

battery, and of traverse magazine in south bastion of the cover-face, which was damaged by a severe rain storm and easterly gale in September, 1882, and to remove the *débris* of the old bridge crossing the ditches of the work, which was destroyed during the same storm.

The condition of the several batteries, &c., remains the same as stated in the annual report of last year, since which time no change has occurred, except the gradual deterioration consequent upon exposing unfinished work to the action of the weather. The completion of the barbette tier of the main work is greatly to be desired to check this progress and to put the fort into a condition to receive its new armament promptly in case of war. The completion of the parados of the 10-gun earthen battery—a work requiring time—for a like reason should not be delayed.

The necessity of immediately resuming work at this place is sufficiently set forth in the remarks upon the fort on Willets Point, which co-operates with Fort Schuyler in the defense of the East River entrance of New York Harbor.

The sum asked for ($50,000) is urgently needed to complete the extension of the barbette tier of the main work and other modifications designed to give room for a modern armament, to repair the sea-wall, and to continue the parados of the 10-gun earthen battery as far as the funds will permit.

Time is essential to this work, and if left until the breaking out of war the position could not be properly defended. The immense military importance of this site for the defense of New York City, and the present dilapidated and unfinished condition of the fortifications, has been often urged. The necessity for immediate action can hardly be stated in too strong language.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year..... $50,000 00

Fort at Willets Point, eastern entrance to New York Harbor, in charge of Lieut. Col. H. L. Abbot, Corps of Engineers.—This fort, which was commenced in 1863, is designed, together with Fort Schuyler, to close the harbor of New York City against the approach from Long Island Sound. In former years the natural obstructions at Hell Gate, the location of the navy-yard and of the great commercial interests near the southern end of Manhattan Island, and the limited range of artillery, all combined to make this channel of much less importance to the defense than that through the Narrows, and the armament and emplacements were accordingly planned on a smaller scale. The modern increase in range and power of artillery, the growth of the city toward the north, and the improvements at the Hell Gate Channel have thus done relatively more to uncover New York City on this side than on the other, and prompt attention is now demanded to prepare for even a respectable defense against any fleet likely to be used in attacking the city.

In the present state of the defenses the torpedo lines could not be properly protected, nor could the works needful for the purpose be constructed in haste. The site is contracted, and the concrete needful for gun-platforms cannot be subjected to heavy shocks when newly laid. It requires time to harden, and it cannot be laid in freezing weather. Time

DEFENSES OF NEW YORK AND THE NAVY-YARD AT BROOKLYN—Continued.

is absolutely essential to proper preparation. It will be a fatal mistake to suppose either that the work can be done promptly at the beginning of a war or that the channel can be effectively closed by torpedoes in the present state of the forts.

That the great commercial metropolis of the country should be left in a condition to invite attack from any third-rate power piratically inclined can only be explained by a widespread popular misapprehension of the actual condition of these defensive works, and of the ease with which an armored fleet could lay the city under contribution.

Fortunately, much work has already been done upon the new earthworks planned since the war, and a moderate sum would add greatly to their present value. The principal part of the grading and sodding is done, and all but three of the traverse magazines are serviceable.

The stone fort, being in an unfinished condition, is gradually deteriorating from the exposure to the weather; and it is very desirable that the second tier arches should be turned and asphalted to protect the casemates, which, in an emergency, would be of much value to the defense. This is doubly important since the armament has been placed in position and requires to be kept covered with paulins, on account of the leakage upon them.

No progress has been made during the year in strengthening this fort, as the available funds have been only sufficient to keep the works in repair. A concrete floor 12 inches thick has been laid in the large storage magazine in rear of the northeast curtain of the stone fort; the slopes of the little bay—west, middle, and mortar batteries—which were considerably damaged by a severe rainstorm and northeasterly gale of four days duration in September, 1882, have been repaired; necessary repairs have been made of temporary building, railroad track, tools, implements, &c. Broken stone for repair of roads have been received.

The torpedo casemate, shaft, and gallery are completed as planned by the Board of Engineers.

An appropriation is desired to continue the construction of the project as now approved, beginning with the completion of the earthen parapet, the gun emplacements, and the traverse magazines. A large appropriation is urgently needed to place the works in a condition to be of use in case of necessity.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year..... $80,000 00

Defenses of Governor's Island, New York Harbor, in charge of Maj. George L. Gillespie, Corps of Engineers.—These works comprise Fort Columbus, Castle Williams, South Battery, and New Barbette Battery. They, with Fort Wood, on the opposite side of the channel, defend the entrances to the East River and the Hudson River. The fortifications on Governor's Island were commenced in 1831. The exterior heavy earthen batteries are as yet unfinished.

For years past no special appropriation has been made for any of the works on this island, and the operations during the year have been limited to repairs.

The exterior slopes of the southwest bastion of Fort Columbus were repaired and resodded, involving the relaying of 2,700 square feet of

DEFENSES OF NEW YORK AND THE NAVY-YARD AT BROOKLYN—Continued.

sod and the rebuilding of 100 cubic yards of earth slope. The first and second interior galleries at Castle Williams, which were unsafe for the guards using them, were partly rebuilt, repaired and painted. No other operations were carried on. An exterior modern earthen battery, designed by the Board of Engineers for Fortifications, and approved by the Secretary of War, is partially built; an appropriation of $75,000 is asked for its completion.

The unfinished works of defense are in about the same condition as at time of last report. The slopes and platforms are generally in good condition.

The appropriation asked is for continuing the construction of the exterior earthen battery for heavy ordnance, designed by the Board of Engineers for Fortifications for this important site, and approved by the Secretary of War.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year	$75,000 00

Sea-wall at Governor's Island, New York Harbor, in charge of Maj. George L. Gillespie, Corps of Engineers.—The project for this improvement, adopted in 1865, provides for inclosing the entire island by a sea-wall. Several short lengths have been built since that time, and the last construction of any importance was made in 1866, when a length of 700 feet was built on the south side. A contract was made for work under the appropriation of $39,000 of August 7, 1882, and the contractor is engaged upon the construction of a granite sea-wall, near the mean low-water line, 1,750 feet long and 8 feet high, backed with concrete; this wall extends from near the main dock on the east side of the island along the west side of Buttermilk Channel, to a connection with the south wall. The wall will rest upon a pile foundation consolidated by concrete, and the space between it and the timber bulkhead on the same front will be filled in with sand or other suitable material.

At the close of the fiscal year 300 linear feet, approximately, of wall and all of the pile foundation were completed, and a small portion of the earth filling put in. The local engineer earnestly recommends, as a matter particularly affecting the health of the garrison, that the north and west fronts be protected by a sea-wall, for which and its earth filling an appropriation of $100,000 is asked.

The appropriation of $15,000 March 3, 1883, will be applied towards the completion of the contract in progress.

Amount appropriated by act passed August 7, 1882		$39,000 00
Amount appropriated by act passed March 3, 1883		15,000 00
Total amount available during fiscal year ending June 30, 1883		54,000 00
Amount expended to June 30, 1883, exclusive of outstanding liabilities	$9,122 74	
Outstanding liabilities	843 86	
		9,966 60
Amount available July 1, 1883		44,033 40
Amount (estimated) required for completing sea-wall around the island		100,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		180,000 00

(See Appendix No. 1.)

DEFENSES OF NEW YORK AND THE NAVY-YARD AT BROOKLYN—Continued.

Fort Wood, Bedloe's Island, New York Harbor, in charge of Maj. George L. Gillespie, Corps of Engineers.—This work, commenced in 1841, forms one of the inner line of defenses for New York Harbor, and with those on Governor's Island is designed to close the entrances to the East River and the Hudson River, and to protect New York, part of Brooklyn, and Jersey City from bombardment.

The operations of the year were limited to slight repairs to the sea-wall on the north side which had been injured by ice and waves.

The exterior modern earthen battery, designed by the Board of Engineers and approved by the Secretary of War, is only partially built and should be completed.

The committee having in charge the erection of the heroic statue of Liberty have already commenced operations of excavating for the foundation of the pedestal in the center of the parade, in accordance with authority of Congress granting the island as the site for the monument. The interior barracks have already been removed. The wharf is out of repair, and it is estimated that its renewal by piles will cost $10,000.

The slopes and platforms are in fair condition.

No appropriation was made for the fiscal year ending June 30, 1884.
Appropriation asked for the year ending June 30, 1885, for the completion of the work according to the present approved plan..... $40,000 00

Fort Hamilton and additional batteries, New York Harbor, in charge of Maj. George L. Gillespie, Corps of Engineers.—These works, commenced in 1824, are situated at the Narrows of New York Harbor, upon the Long Island side.

No specific appropriation was made for the fiscal year, and the operations were confined to repairs absolutely necessary for the preservation of the works. These include the relaying of the brick pavement of the sallyport leading to the caponiere; rebuilding and repainting wooden bridge across the redoubt ditch, cleaning, grading, and repairing surface drains of the fort, and those in rear of the 15-inch gun battery; relaying eight broken lengths of the drain pipe through the south end of Battery No. 1; repairing 300 feet of exterior slope of 15-inch gun battery damaged by land slide, involving the rebuilding of 420 cubic yards of earth slope and the relaying of 4,400 square feet of sod; erecting hand railing on the counterscarp steps of northeast ditch; rebuilding six ventilators to the center caponiere; repairing embrasures and coping in the northeast and south front; repairing and painting the tin roof of the piazza on the east side of parade, and building an open cobble drain 1,100 feet long and 2 feet wide to carry off drainage of slopes of the 15-inch gun battery. The north slope of the county road near the cesspool at the foot of the retaining-wall of the face-cover was also protected by cobble work. The cobble-stone work whenever used was covered with a thin coating of asphaltic concrete to prevent growth of grass.

The slopes and revetments of the several batteries, as well as the platforms of the guns, are generally in good condition.

A cobble surface-drain is much needed behind the 15-inch gun battery. It is noticed that heavy rains are usually succeeded by numerous land slides to the slopes, and the settlement of the embankments causes breakages of the earthen drain pipes through them.

DEFENSES OF NEW YORK AND THE NAVY-YARD AT BROOKLYN—Continued.

For these repairs and for the completion of the earthen batteries now in part constructed, in accordance with plans designed by the Board of Engineers for Fortifications, approved by the Secretary of War, an appropriation for the next fiscal year is recommended.

No appropriation was made for the fiscal year ending June 30, 1884.
Appropriation asked for the next fiscal year..... $50,000 00

Mortar Battery at Fort Hamilton, New York Harbor, in charge of Maj. George L. Gillespie, Corps of Engineers.—This battery was commenced in 1871. No operations were carried on during the year. But little requires to be done to fit this battery to receive its full armament as projected by the Board of Engineers for Fortifications.

The expense will be borne by the appropriation asked for Fort Hamilton and additional batteries.

Fort Lafayette, New York Harbor.—This old work, commenced in 1812, and situated on a shoal at the Narrows entrance, occupies the best of all the positions for the defense of New York Harbor. It was injured by fire in December, 1868, to such a degree as to make it practically worthless, unless repaired at a very considerable outlay; and as it was adapted to guns of small caliber only, it was not thought worth while to restore it, but to replace it by an iron construction which should meet the demands of modern armaments. The plans for this have been prepared.

The defense of New York Harbor requires a new work on this shoal which will admit of the mounting of 80 to 100 ton guns. It will require several years in building, and should be undertaken without delay.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.
Appropriation asked for the next fiscal year..... $200,000 00

Fort Wadsworth, Staten Island, New York Harbor, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, to March 31, 1883, when temporarily in charge of Capt. J. C. Post, Corps of Engineers.—This fort, commenced in 1847, is situated on the west side of the Narrows, and constitutes a part of the second line of defense of the southern water approach to New York.

It is an inclosed work, built of granite, containing three tiers of guns in casemates, and one *en barbette*, the lower tier being only a few feet above the water level.

The work, in connection with those adjacent to it on either side, Fort Tompkins and the two Glacis Batteries on the hill in rear, is designed to throw a heavy concentrated fire on vessels approaching or attempting to pass through the Narrows, crossing its fire with that from Fort Hamilton and batteries on the opposite side of the channel.

The centering was struck from the concrete arch built over the freshwater reservoir during the preceding fiscal year, and the timber supports stored in the casemates of Fort Tompkins.

The stationary part of the draw-bridge which had become rotten was renewed.

A new boiler for the force-pump supplying the garrison with water was put in position. The sea-wall in front of the fort was repaired.

The masonry of the wharf, north of the fort, was pointed with Port

DEFENSES OF NEW YORK AND THE NAVY-YARD AT BROOKLYN—Continued.

land cement, and material was procured and preparations made for driving fender piles in front of the wharf.

An appropriation of $10,000 is asked for next fiscal year, to be expended in clearing the ditch of the sand washed in from the slope of the hill in rear, in painting the iron-work in the embrasures, in pointing the masonry of the whole work, and in replacing 25 old pintles in the barbette gun platform with new 4-inch pintles.

No appropriation having been made, no work was done at the fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for the next fiscal year $10,000 00

Fort on site of Fort Tompkins, New York Harbor, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This work, commenced in 1858, with the earthen Glacis Gun Battery on its left, and the Glacis Mortar Battery on its right, crowns the hill in rear of Fort Wadsworth and the earthen batteries known as North Cliff Battery, South Cliff Battery, Battery Hudson, and the South Mortar Battery.

It is an inclosed pentagonal work, having on its four land faces two tiers of casemate quarters, a deep, dry ditch, and a heavy battery to resist a land attack, and on its channel front seventeen large casemates for storage and other purposes. It mounts its channel-bearing guns *en barbette.* It is intended to supply quarters for the garrison and act as a keep for all the defensive works occupying this position. Properly armed, this work will be able to throw a heavy fire from a commanding position upon vessels attempting to pass through the Narrows.

The four land faces were, for all defensive purposes, finished in 1865. In December, 1869, a plan giving such increased depth to the casemates that heavy rifled guns could be mounted over them *en barbette* was adopted and carried into execution.

Since 1876 the work has been in readiness to receive, on temporary platforms, all the heavy guns intended for channel defense.

The wooden treads and landings leading to the barbette of the channel front and the balcony floor were repaired where most needed. The iron railings and the brackets supporting balcony and stairs were painted.

The fronts of inclosed casemates of channel front were painted and sanded, and a number of torpedo junction boxes stored in them.

The northerly half of the parade was top-dressed with manure, and the sodding of exterior slope and traverse magazines rammed.

The road leading from the south sallyport to the light-house was repaired and a gutter paved on its west side. A gutter was also paved along the east side of the road between the north and south sallyports.

The grass and weeds on the parade, eastern slope, and traverse magazines was cut several times during the year.

The boundary fence on New York avenue was repaired.

The two gates or valves in the 6-inch pipe leading from the upper reservoir to the soldiers' latrine were repaired and replaced, and the iron work in the unoccupied casemates painted.

The estimates for the completion of Fort Tompkins comprise 10 per-

DEFENSES OF NEW YORK AND THE NAVY-YARD AT BROOKLYN—Continued.

manent gun platforms in place of the present wooden ones, 4 bonnets on the traverses for the better protection of guns and gunners, and finishing off 26 casemates for quarters, and 11 large casemates on the channel front for storage purposes. The appropriations for the Glacis Battery and the North Cliff and South Cliff batteries are included in that for Fort Tompkins.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.
Appropriation asked for next fiscal year..... ..... $75,000 00

Glacis Gun Battery (north of fort on site of Fort Tompkins), Staten Island, New York Harbor, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This earthen barbette battery, built in 1872, is designed to supplement the barbette fire of Fort Tompkins. It has been in readiness to receive its armament on temporary platforms for the last six years, and may be reported as finished, although some little work remains to be done to the magazine doors and lamp closets. It is provided with timber gun platforms and ample magazine room.

The cost of substituting stone for the timber gun platforms, and raising the breast-height wall, in all amounting to $8,250, is included in the estimate for fort on site of Fort Tompkins. No separate appropriation asked for this work.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Glacis Mortar Battery (south of fort on site of Fort Tompkins), Staten Island, New York Harbor, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 20, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This battery, built in 1872 and 1873, is intended to throw a powerful vertical fire upon vessels approaching or attempting to pass through the Narrows. It is provided with ample storage and service magazine room, and is ready for service, although a little work yet remains to be done to the magazine lamp closets, and the principal magazine requires to be lined with wood. All the mortar platforms require more or less repairs, the upper tier of oak pieces being rotten at the heart. The pine timber of lower tier is in good condition.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.
Appropriation asked for next fiscal year in the estimates under the general head of sea-coast mortar-batteries.

Battery Hudson, Staten Island, New York Harbor, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This work, built in 1841 to 1843, and the North Cliff and South

DEFENSES OF NEW YORK AND THE NAVY-YARD AT BROOKLYN—Continued.

Cliff batteries occupy the slope of the hill between the fort on site of Fort Tompkins and the water, and are able to bring a powerful direct fire upon the channel leading up to and through the Narrows.

For want of funds no work except that of preservation and repair has been done since the close of the fiscal year ending June 30, 1876. One of the new platforms was constructed for King's depressing carriage and a 15-inch smooth-bore gun mounted thereon.

The work necessary for the completion of this battery comprises twelve new permanent gun platforms in place of old ones, the construction of a new breast-height wall in front of some of the platforms, and raising the wall to a higher level in front of others, the construction of bonnets on the traverses, and the placing of a wooden lining in one of the principal magazines.

The work done last fiscal year was limited to cutting grass and weeds on the principal traverse magazines, and in beginning pointing the masonry of the breast-height wall on the channel front of the battery.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year..... $20,000 00

South Mortar Battery (in rear of Battery Hudson Extension), Staten Island, New York Harbor, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This battery, commenced in 1872, is situated south of Fort Tompkins and directly in rear of Battery Hudson Extension. It is designed to throw a heavy vertical fire upon vessels approaching the Narrows from the lower bay. Since 1873 no appropriation has been made for it. The work necessary for its completion consists in constructing and laying eight timber mortar-platforms, and in fitting up the inner magazines with doors and lamp closets. Estimated cost of completing the work, $9,000.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year in the estimates under the general head of sea-coast mortar-batteries.

North Cliff Battery, Staten Island, New York Harbor, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This earthen gun battery, which was commenced in 1862, is located north of Fort Wadsworth, on the slope of the hill between Fort Tompkins and the water. It is designed to throw a direct fire upon vessels attempting to pass through the Narrows. It was intended for an armament of 15-inch smooth-bore guns or corresponding rifles, and was provided with two storage magazines, one large bomb-proof shelter, and five traverses between guns, two of them containing service magazines. Under a modification approved December 8, 1869, the bomb-proof shelter was suppressed and some traverses and service magazines between the guns were added, the number of guns being necessarily reduced thereby.

DEFENSES OF NEW YORK AND THE NAVY-YARD AT BROOKLYN—Continued.

During the past fiscal year, the slope of the earth covering over the principal magazine near the north end of the work, which had been damaged by storms, was thoroughly repaired; also the slopes of the traverse magazines near by. A large portion of the slopes was resodded and rammed. The covering of the large magazine at the south end of the battery was repaired, and partly resodded and rammed.

The gutters have been cleaned, and grass and weeds cut.

The large slope in rear of the battery has been repaired and sodded.

Wooden steps were built leading from the terreplein of the battery over the parapet and down the exterior slope, for convenient communication with the wharf near Fort Wadsworth.

The cost of finishing this battery, by substituting six stone gun platforms for those of timber, constructing six breast-height walls, two bonnets on the traverses, lining the two principal magazines with wood, thickening the parapet, and constructing a rough sea-wall at the foot of the exterior slope, amounting in the aggregate to $35,000, is included in the estimate for fort on site of Fort Tompkins.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

South Cliff Battery, Staten Island, New York Harbor, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This earthen gun battery, occupying the slope of the hill between Fort Tompkins and the water directly south of Fort Wadsworth, was built in 1858 to 1861 for 15-inch guns or corresponding rifles, and was provided with two storage and two service magazines. In December, 1869, modifications were ordered, adding four new traverses, including two traverse magazines, by which the number of guns was necessarily reduced.

All the gun platforms required by the new plan are in serviceable condition, although only two of them are supplied with 6-inch pintles. All the other pintles are 5 inches in diameter. Much work remains to be done on the magazines and traverses.

The traverse magazine at the north end of the battery has been repaired and partly resodded, and the slope in the rear of the magazine at the south end has been graded and sodded.

The cost of finishing the battery, comprising the completion of four traverses, the construction of one new traverse magazine, adding to the thickness of the parapet, building a rough sea-wall at the foot of the exterior slope, lining the two principal magazines, and putting in new 6-inch pintles, amounting in the aggregate to $37,000, is included in the estimate for fort on site of Fort Tompkins.

At the south end of this work, near the entrance to the principal magazine, a retaining-wall has been built. The large slope in rear of the battery was repaired and regraded.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

DEFENSES OF NEW YORK AND THE NAVY-YARD AT BROOKLYN—Continued.

Two-gun Battery (near southeast angle of channel front of fort on site of Fort Tompkins, Staten Island, New York Harbor, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This work is located on the crest of the long slope in rear of Fort Wadsworth, and to the southeast and somewhat in advance of the channel front of the fort on site of Fort Tompkins. It was built towards the close of the late civil war, and is designed to throw additional fire from a commanding position upon vessels attempting to pass the Narrows.

No appropriation is asked for this work.

Fort at Sandy Hook, New Jersey, in charge of Maj. George L. Gillespie, Corps of Engineers.—This casemated work, commenced in 1857, commands the southern approaches by sea to the harbor and city of New York, and is also designed to prevent the occupation of the Lower New York Bay as an anchorage by an enemy's fleet.

No regular appropriations have been made for years past for the completion or modification of this work, and it remains in essentially the same condition as at the date of last annual report.

An allotment of $17,500 was made from the appropriation for preservation and repair of fortifications, 1883, for the protection of the site of the work, seriously encroached upon on the shore-line east of the fort by the severe storms of the past winter and early spring. With this amount a total of 766 feet of concrete jetties were built on the sites and remains of old jetties Nos. 1, 3, 4, 5, and 8, the new jetties having an average cross-section of 52 square feet. Although the sum available for the purpose was not sufficient to carry out the shore protection to the full extent intended, the result obtained so far shows a marked improvement on that portion of the beach protected by the new-built jetties.

This work is the most advanced of all the defenses of the southern approaches by sea to the harbor and city of New York. The channel of entrance opposite the Hook is more than a mile wide, and of depth sufficient for the largest and most powerful armored vessels yet built or designed. The occupation by an enemy's fleet of the capacious bay just within the Hook would prevent all egress from the harbor southward to the sea, and effectually seal up the main outlet from the city. The modification and completion of this important work for the reception of the heaviest modern rifled guns, protected by impenetrable iron armor, and the protection of the site against encroachments by the sea, are of very great importance, and an appropriation therefor is urgently recommended.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year:

For modification of the work	$150,000 00
For protection of site	25,000 00
	175,000 00

DEFENSES OF PHILADELPHIA, AND LEAGUE ISLAND NAVY-YARD.

Fort Mifflin, Delaware River, Pennsylvania, in charge of Maj. William Ludlow, Corps of Engineers, until August 12, 1882; *since that date in charge of Lieut. Col. Godfrey Weitzel, Corps of Engineers.*—This barbette

DEFENSES OF PHILADELPHIA, AND LEAGUE ISLAND NAVY-YARD—Continued.

work, originally established in 1779, is situated on the west bank of the Delaware River, within the territorial boundaries of the city of Philadelphia, and constitutes a part of the inner line of works for the defense of the city and the League Island naval station.

No specific appropriation has been made for this fort since 1875, when the operations which were in progress in the construction of exterior earthworks for the mounting of heavy guns, under the approved plans of the Board of Engineers for Fortifications, terminated.

Operations for the past year have been directed to the general care and preservation of the works, including repairs to breast-height wall; to copings over arch at main entrance; to main magazine; to dikes along the river front; to hospital building and commandant's quarters; the rebuilding of bridges and construction of a protection wall on the east side of moat, in demilune.

During the current fiscal year it is proposed to make repairs to the outer portion of dike on Delaware River front, to pier at fort landing, to soldiers' barracks, to magazine and parapets, and to main sluice; also to construct a bridge over the moat.

Should adequate appropriation be made for 1884–'85, the plans already prepared would be pursued as follows: Constructing torpedo casemate gallery; completing exterior earthen battery; constructing earthen battery on north face of demilune; constructing an earthen battery on south face, with two traverses; commencing storage magazine for exterior earthen battery.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year $75,000 00

Mortar-battery at Fort Mifflin, Pennsylvania, in charge of Maj. William Ludlow, Corps of Engineers, until August 12, 1882; *since that date in charge of Lieut. Col. Godfrey Weitzel, Corps of Engineers.*—This work is situated west of the main work and in rear of the unfinished gun-battery. It was commenced in 1871, under the approved plans of the Board of Engineers for Fortifications, and has remained in its present unfinished state since 1874, no appropriation having been made for continuing its construction.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year in the estimates under the general head of sea-coast mortar-batteries.

Site for defenses at Red Bank, New Jersey, in charge of Maj. William Ludlow, Corps of Engineers, until August 12, 1882; *since that date in charge of Lieut. Col. Godfrey Weitzel, Corps of Engineers.*—This site is on a bluff on the east (New Jersey) shore of the Delaware River, and covers about 100 acres. It was purchased in 1872, with the view of erecting thereon an earthen barbette work for heavy guns, which, with the works at Fort Mifflin, nearly opposite, would constitute the inner line of defenses of the Delaware River.

DEFENSES OF PHILADELPHIA, AND LEAGUE ISLAND NAVY-YARD—Continued.

No appropriation has been made for this work. The site is an important one, the occupation of the bluff by a suitable armament, which would command the channel at short range, being indispensable to any attempt to defend the port of Philadelphia and the League Island navy-yard.

No appropriation was made for the fiscal year ending June 30, 1883.
No appropriation asked for next fiscal year.

Fort Delaware, Delaware River, Delaware, in charge of Maj. William Ludlow, Corps of Engineers, until August 12, 1882; *since that date in charge of Lieut. Col. Godfrey Weitzel, Corps of Engineers.*—Fort Delaware is a casemated work, with granite scarp, situated on Pea Patch Island, about 42 miles below Philadelphia, and 12 miles below Wilmington, Del.

The position is a very important one, commanding both channels, the eastern or main ship channel passing within 1,000 yards of the fort.

The masonry of this fort was begun in 1852. No appropriations have been made for it since 1876, and the modifications then in progress, to adapt it to the greater size and power of modern ordnance, remain suspended.

This work and the batteries opposite on the Delaware and New Jersey shores form the lower line of defense for the Delaware River, but the fort is in no condition to contest the passage of modern ships of war, and neither the thickness of the scarp nor of the magazine walls are sufficient to resist shot from guns now in use.

Nothing has been done during the past year, and the condition of the fort remains as reported last year. Extensive repairs are required to the fort and buildings, and the dike around the island should be raised at least 2 feet to insure safety from inundation.

An appropriation for these purposes and for constructing a torpedo casemate and otherwise modifying the work, according to approved plans of the Board of Engineers for Fortifications, is urgently recommended.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.
Appropriation asked for next fiscal year..... $55,000 00

Battery at Finn's Point, Delaware River, New Jersey, in charge of Maj. William Ludlow, Corps of Engineers, until August 12, 1882; *since that date in charge of Lieut. Col. Godfrey Weitzel, Corps of Engineers.*—The construction of this earthen barbette battery, which forms the left of the lower line of defense for the Delaware River, was commenced in 1872, under the approved plans of the Board of Engineers for Fortifications. In 1876 work was suspended for want of appropriations, and since then only slight repairs have been made from time to time. The sea-wall and the unfinished embankments have suffered much damage from storms, but most of the sodded slopes and breast-height walls are in good condition.

During the past year that part of the sea-wall lying below the wharf, and a length of 190 feet of that above the wharf, has been repaired and

raised to a height of 12 feet above low water, two feet higher than heretofore.

To afford adequate protection to the exterior slope of the battery, it is necessary that the repair and raising of this sea-wall should be continued.

An appropriation is asked for the next fiscal year to repair the dike and sea-wall, construct four gun-platforms, with breast-height wall; two magazines and traverses; covered passage from the wharf, through the battery, and to continue the embankments.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year..... $75,000 00

Mortar battery at Finn's Point, Delaware River, New Jersey, in charge of Maj. William Ludlow, Corps of Engineers, until August 12, 1882; *since that date in charge of Lieut. Col. Godfrey Weitzel, Corps of Engineers.*—This work was commenced in 1872, under the approved plans of the Board of Engineers for Fortifications, and forms a part of the earthen battery at Finn's Point. No appropriations having been made for it since 1874, it remains in its then incomplete condition. Since then the embankments have been washed away to a great extent by severe storms, which badly damaged the sea-wall at their foot.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year in the estimates under the general head of sea-coast mortar batteries.

Fort opposite Fort Delaware, Delaware shore, in charge of Maj. William Ludlow, Corps of Engineers, until August 12, 1882; *since that date in charge of Lieut. Col. Godfrey Weitzel, Corps of Engineers.*—This earthen barbette battery is on the Delaware shore, opposite Fort Delaware, and commands both channels of the river below Pea Patch Island.

Its construction was commenced in 1873, and continued until 1876. Since that time no appropriations have been made, and the battery remains in an unfinished condition.

The completed parts, including the sodded slopes, are in good order. The river dike was broken down by the severe storm of October, 1878, and is wearing away every year. It needs to be repaired and built up to a proper height.

No work has been done during the past year.

An appropriation is recommended for continuing the construction of the battery, under the plans of the Board of Engineers for Fortifications, and the protection of its site, to be applied as follows: Rebuilding the river dike; completion of torpedo cable gallery; construction of six additional gun-platforms, with the necessary breast-height wall; three magazines and three traverses; and continuing the embankment of the battery.

No appropriation having been made, no work was done at this fortification during the last fiscal year, and no work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year..... $75,000 00

DEFENSES OF PHILADELPHIA, AND LEAGUE ISLAND NAVY-YARD—Continued.

Mortar battery opposite Fort Delaware, near Delaware City, Delaware, in charge of Maj. William Ludlow, Corps of Engineers, until August 12, 1882; *since that date in charge of Lieut. Col. Godfrey Weitzel, Corps of Engineers.*—The construction of this battery was commenced in 1872, according to plans prepared by the Board of Engineers for Fortifications, and in the next year two magazines were nearly completed, the terreplein was formed, and the parapet embanked about 7 feet above that level. Nothing more was done until 1876, when a small balance of an old appropriation was applied to completing the two magazines and embanking the two traverses, with the parapet in front of them, to nearly their full height. The work is in an unfinished condition.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year in the estimates under the general head of sea-coast mortar batteries.

DEFENSES OF BALTIMORE.

Fort McHenry, Baltimore Harbor, Maryland, in charge of Lieut. Col. William P. Craighill, Corps of Engineers, until August 21, 1882; *temporarily in charge of Capt. Thomas Turtle, Corps of Engineers, until November* 7, 1882; *since that date in charge of Lieut. Col. William P. Craighill, Corps of Engineers.*—This fort forms part of the inner line of defense for Baltimore and its dependent interests, and commands with its fire the interior waters of the harbor and the channel of approach thereto, in which latter a depth of 24 feet exists at mean low water.

The fortifications at this place were commenced in 1775, and in 1794 the present work was built.

Although the original fort has become almost useless as a defensive work, the site is still an important one, and the water-front should be occupied by a battery of modern guns, mounted behind an earthen parapet of the most approved dimensions, and provided with bomb-proof cover for ammunition and gunners. Such a battery, the plans of which were prepared by the Board of Engineers for Fortifications, was commenced in 1872, and is partly constructed, although all work upon it has been suspended for want of funds since July, 1876.

A bulkhead of ballast having been made by the United States, without expense, along a line in front of the site, and at a distance from the authorized pier line of 375 feet, and a line having also been established in the rear of the site at the same distance from the pier line, it is proposed to fill in the whole area thus defined with ballast from ships coming to the port. The available limits of the site will thus be largely increased without expense to the United States. Little progress has been made in this filling during the past year, as but few vessels have applied to deposit ballast upon the area.

A sea-wall should be built along the line of the temporary bulkheads referred to above, and the present wharf should be removed and a new one built near the new dry-dock.

During the fiscal year repairs have been made to the slopes of the new water battery, to the slopes of the main road embankment, and to the slopes of the magazine and traverse in the covered way of the south-

DEFENSES OF BALTIMORE—Continued.

east front of the main work; the slopes, the glacis, and the surrounding area have been mowed; and the concrete flooring of the rooms on each side of the sallyport and the repointing and repair of the scarp of the main work have been commenced.

To continue work on the new earthen battery the sum of $50,000 is asked for the next fiscal year, which would nearly complete the parapet and terreplein of the unfinished battery, including magazines, but not the gun-platforms.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year $50,000 00

Fort Carroll, Baltimore Harbor, Maryland, in charge of Lieut. Col. William P. Craighill, Corps of Engineers, until August 21, 1882; *temporarily in charge of Capt. Thomas Turtle, Corps of Engineers, until November* 7, 1882; *since that date in charge of Lieut. Col. William P. Craighill, Corps of Engineers.*—This fortification, commenced in 1847, is situated upon an exterior line of defense for the harbor of Baltimore.

It is proposed to modify this important casemated work so as to enable it to receive the heaviest modern rifled guns, protected by iron armor of such form and thickness as to be impenetrable by any guns which may be brought to our coasts. Its completion is indispensable to the safety of the rich city of Baltimore in time of foreign war, and the work to be done cannot safely be left until the approach of hostilities. It will require several years and liberal appropriations to accomplish it, and it should be commenced without delay.

Operations during the past year have been confined to the general care and preservation of the work and the public property stored thereat.

The roof over the unfinished casemates on the east half of Front 2 and at the salient of Fronts 1 and 2 had become dilapidated, and these casemates have been covered by 8,000 square feet of graveled felt roofing, a portion of the old material being used for support.

The screen fence on a portion of Front 6 has been extended to the scarp of Front 5, and repairs of little extent have been made to the quarters of the fort-keeper.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year $100,000 00

DEFENSES OF WASHINGTON.

Fort Foote, Potomac River, Maryland, in charge of Lieut. Col. William P. Craighill, Corps of Engineers, until August 21, 1882; *temporarily in charge of Capt. Thomas Turtle, Corps of Engineers, until November* 4, 1882; *since that date in charge of Maj. Peter C. Hains, Corps of Engineers.*—This earthwork, commenced in 1862, is on the inner line of defense of the channel of approach by water to Alexandria and the capital of the United States. The site is commanding and very favorable.

Projects for the modification of this fort and for an additional battery for the use of the heaviest modern guns have been prepared by the Board of Engineers for Fortifications. They were partially executed when

DEFENSES OF WASHIGTON—Continued.

work was suspended by reason of failure of appropriations, the last of which was for the fiscal year ending June 30, 1874. Attention is again urged to the fact that the fort in its present unfinished condition is daily becoming much deteriorated. The modification of the work should be resumed and completed as soon as possible.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year $50,000 00

Fort Washington, Potomac River, Maryland, in charge of Lieut. Col. William P. Craighill, Corps of Engineers, until August 21, 1882, *temporarily in charge of Capt. Thomas Turtle, Corps of Engineers, until November* 4, 1882; *since that date in charge of Maj. Peter C. Hains, Corps of Engineers.*—This fort occupies a very important position on the outer line of defense of the cities of Alexandria, Washington, and Georgetown, and the interests connected with them.

The importance of this site has been fully set forth in previous annual reports. The casemated fort, commenced in 1816, is of very little value, and the new earthen batteries, which have been devised in accordance with the latest ideas of defensive arrangement, have been barely begun. There has been no specific appropriation for this place since that for the fiscal year 1873–'74. The unfinished work is constantly suffering deterioration.

Attention is again earnestly asked to the need of continuing and finishing the new batteries.

At the present time there is really nothing in the way of defensive shore works to stop a single hostile ship from approaching within easy range of the capital. The earthen batteries, at least, should be completed.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year $50,000 00

Obstructions of the Potomac, in charge of Lieut. Col. William P. Craighill, Corps of Engineers, until August 21, 1882; *temporarily in charge of Capt. Thomas Turtle, Corps of Engineers, until November* 4, 1822; *since that date in charge of Maj. Peter C. Hains, Corps of Engineers.*—The material pertaining to these obstructions was continued in store at Fort Foote, Md., in charge of a watchman. The timber portion has become entirely worthless from decay. The irons are in good condition, and have recently been examined, counted, and re-stored.

DEFENSES OF HAMPTON ROADS AND GOSPORT NAVY-YARD.

Fort Monroe, Old Point Comfort, Virginia, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This extensive work, commenced in 1817, occupies an important position, covering, in co-operation with Fort Wool, on the opposite side of the channel, the only approach from the sea to Hampton Roads, the cities of Norfolk and Portsmouth, the Gosport navy-yard, and the James River.

DEFENSES OF HAMPTON ROADS AND GOSPORT NAVY-YARD—Continued.

These works, also, in offering a safe rendezvous for our own vessels of war, afford indirect protection to Baltimore, Annapolis, and Washington, and all the harbors and towns on the Chesapeake Bay and Potomac River. The work covers an area of 86 acres, and the distance around it is $1\frac{3}{4}$ miles.

The modifications that have been planned and approved for adapting Fort Monroe to the requirements of efficient defense against war vessels of recent type contemplate arming the channel front of the advanced redoubt with heavy barbette guns, provided with suitable traverses and traverse magazines; mounting a similar armament in the re-entering place of arms, located on the right of the redoubt in advance of Front No. 5; constructing a new open battery for barbette guns to the right of the old casemated water battery; and placing a few heavy guns in the salients of the main work and covered way. There is plenty of room for mortar batteries both within and without the work.

The work of making the requisite modifications has been suspended for several years past for want of appropriations.

In the advanced earthen redoubt the two traverse magazines are finished, except the earth covering to one of them, and six gun-platforms are nearly completed. Most of the earthwork of the redoubt is also finished. In the place of arms, the concrete service magazine is finished, but not covered with earth, and the concrete foundations for the gun-platforms have been laid. The new 10-gun earthen battery has not been commenced.

The operations during the last fiscal year were confined to the repairs necessary for the protection and preservation of the work.

Six hundred and fifty linear feet of sheet-piling breakwater between the hotel tract and the engineer's wharf were built, and about 4,000 feet of granite on the beach were moved and stored, under contracts made toward the end of the preceding fiscal year. About 520 linear feet of the breakwater having become damaged by storm were thoroughly repaired and solidly backed in June last, and the space in rear to the roadway filled and graded.

Five thousand eight hundred linear feet of railroad iron and 10 railroad frogs were taken up and stored.

A traverse magazine in the advanced redoubt and another in the place of arms were housed to protect them from the weather.

The old decayed plank walk at the foot of the glacis was taken up and replaced by a new one of 1,300 feet length and 4 feet width.

Five hundred linear feet of paling fence in rear of engineer's quarters were built in place of the old decayed fence.

Two brick flues were built with ventilators, slate mantels, and other fixtures, in the casemates occupied by the officers, in bastion between Fronts 1 and 2.

One thousand and eighty-seven linear feet brick gutter was laid to drain the roadway skirting the parade, and the road bed graded to the gutter. The brick sewer leading from foot or ramp, Fronts 1 and 2, was cleaned and enlarged, and the drain into which it leads was cleaned.

Repairs have been made to the slopes and parapet of the main work and in front of the three 15-inch gun-platforms east end of water battery.

The engineer's building, cisterns, &c., were repaired, and the engineer's storehouse, shops, and fences white and yellow washed.

DEFENSES OF HAMPTON ROADS AND GOSPORT NAVY-YARD—Continued.

Grass was cut on the parapet and exterior slopes of the main work, and on the glacis on front of it.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.
Appropriation asked for next fiscal year $75,000 00

Artesian well at Fort Monroe, Virginia, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—No work was done during the last fiscal year, and none is contemplated during the present fiscal year, for want of funds. The inadequate and uncertain supply of water at Fort Monroe is an evil which, it is conceded on all sides, may at any time arise to serious magnitude. The present depth of the well is about 900 feet. It is recommended that provision be made to increase this depth to 1,200 or even 1,500 feet before abandoning the project of obtaining a water supply by this method.

No appropriation was made for the fiscal year ending June 30, 1884.
Appropriation asked for next fiscal year..... $10,000 00

Fort Wool, Hampton Roads, Virginia, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This work unites with Fort Monroe in closing the sea approach to Hampton Roads, being located on the opposite side of the channel from that work, and therefore crossing its fire with it.

Fort Wool is an inclosed casemated fort. It was begun in 1818 by forming an artificial foundation with stone of random sizes, unloaded upon a 10-foot shoal, selected as the site of the work. When the scarp wall and piers had reached a height to include the lintels of the lower tier of embrasures settlement began, and work was stopped after piling a quantity of stone upon the walls sufficient to bring upon the foundation a pressure somewhat exceeding that of the finished work.

The work of construction was resumed in 1858, and when it was suspended 52 casemates of the lower tier, with iron-throated embrasures, were finished and ready for the guns. On the second tier the scarp wall and piers of those portions of the work bearing on the channel had reached nearly to the height of the embrasure lintels, the embrasure irons had been set, and the floors of most of the casemates paved. On the gorge faces very little work had been done.

During the past fiscal year the fort-keeper's quarters and other buildings were repaired and painted, and a portion of the masonry of the upper tier of casemates was pointed.

It is designed to modify this important work so that it may receive the heaviest modern rifled guns, protected by impenetrable iron armor. The work to be done, which will require several years for its execution, cannot be left until the near approach of war, and a liberal appropriation for it is urgently recommended.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.
Appropriation asked for next fiscal year $150,000 00

DEFENSES OF BEAUFORT HARBOR, NORTH CAROLINA.

Fort Macon, Beaufort Harbor, North Carolina, in charge of Col. Q. A. Gillmore, Corps of Engineers, until October 17, 1882; *since that date in charge of Capt. James Mercer, Corps of Engineers.*—This barbette work, commenced in 1826, is situated at the mouth of the harbor, on the south side, and defends the approach thereto from the sea.

Nothing has been done during the year to the main work, except to clear away the bushes on the parapet and glacis, and repair the surrounding fence.

For the preservation of the site of the work, three of the four jetties have been repaired and extended, and the old sand-catch fences have been repaired, and 5,962 feet of new fence have been built.

The action of the jetties and fences has been remarkably successful, but the wearing away of the beach inside Jetty No. 1, indicates that one or two new jetties will be needed to thoroughly protect the site.

A project for adapting this work to the requirements of modern defense is under consideration.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropiation asked for next fiscal year.

DEFENSES OF WILMINGTON.

Fort Caswell, mouth of Cape Fear River, North Carolina, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This barbette work, commenced in 1826, covers the entrance into Cape Fear River, and hence the water approach to the city of Wilmington, and constitutes the only defense of that locality.

Upon its evacuation by the Confederate forces in January, 1865, immediately after the fall of Fort Fisher, an attempt was made to blow it up. All the scarp wall of the southeast face was overturned by a mine exploded in the scarp gallery of that face; a portion of the scarp wall of the north and west fronts was so badly shattered by the explosion of a magazine on the covered way near northwest salient that it will have to be rebuilt, and the citadel on the parade of the work was burned. There is now neither armament nor quarters for a garrison at the place.

The subject of its modification is now under consideration.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

DEFENSES OF CHARLESTON.

Fort Moultrie, Charleston Harbor, South Carolina, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This work is located on Sullivan's Island, and co-operates with Fort Sumter in defending the water approach from the sea to the city and harbor of Charleston. It is an earthen barbette work, and was commenced in 1841.

The completion of the work comprises the construction of eleven permanent gun-platforms and breast-height walls, bonnets on the traverses, portion of the masonry and all the earth covering of the bomb-proof

DEFENSES OF CHARLESTON—Continued.

shelter, the postern gallery, a part of the earth covering of the magazines, and an earthen cover face on the channel front.

During the past fiscal year the the magazines and traverses of the fort were protected by a covering with lumber, the slopes were repaired, and a brick drain built from the northeast angle of the work to the main drain, and the latter was cleaned out. Temporary gates were made and hung in the sallyport and the wooden steps on slopes renewed.

Nothing was done at this place during the last fiscal year beyond placing a wooden covering on the principal magazine, cleaning up the grounds in and about the fort, and making some slight repairs to the fort-keeper's house.

Every one of the nine wooden platforms for 15-inch guns in the fort contains some more or less rotten members, which should be removed and replaced by sound timbers to render the platforms fit for service.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year $50,000 00

Fort Sumter, Charleston Harbor, South Carolina, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, to March 31, 1883, when temporarily in charge of Capt. J. C. Post, Corps of Engineers.—This casemated work is located on a shoal on the south side of the entrance into the harbor, and its guns, crossing their fire with those of Fort Moultrie, on Sullivan's Island, command the only channel of approach thereto practicable for vessels of war.

Its construction was begun in 1829, and was nearly finished, although still wanting most of its armament, when, in April, 1861, it was captured by the Confederate forces. It was held by them until February 18, 1865.

The reconstruction of the work with the view of adapting it to the conditions of modern defense was begun in 1870, and is now well advanced. Of the barbette gun-platforms required eight have been laid. Three of these eight are permanent, and five are of timber, four of the latter being occupied by two 15-inch guns and two 200-pounder Parrott rifles.

By replacing two platforms on the southeast face now occupied by light guns with heavy platforms, timber for which has already been provided, the work would be ready for its barbette armament. Eight casemates on the northwest face are ready for the guns, except the traverse circles, and the nine casemates on the northeast face, one in the *pan coupé* between the northeast and north faces, and one adjacent thereto on the north face (eleven in all) are armed.

The completion of this work comprises the construction of seven permanent gun-platforms and their breast-height walls, placing bonnets on the traverses, most of the earthwork on the gorge face and the parades and magazines adjacent thereto, the arrangement of a room for torpedo defense, and the repair and extension of the wharf and other matters of detail.

During the past fiscal year the cribs of the new wharf were filled with riprap; the sand was removed from the casemates of the northeast front, from the galleries, and from the passages leading to magazines; temporary wooden doors were made for entrances to magazine passages;

DEFENSES OF CHARLESTON—Continued.

wooden doors for the embrasures were made and fitted; slopes repaired and graded, and the fort-keeper's quarters repaired and painted.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.
Appropriation asked for next fiscal year $20,000 00

Fort Johnson, Charleston Harbor, South Carolina, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This old work, situated on James Island, a little more than 1¼ miles west of Fort Sumter, should constitute one of the inner works in the system of defense for this locality.

It is a fort only in name, having neither armament nor magazines, but only some irregular mounds of earth, representing what remains of the battery found there at the close of the civil war.

The project for reconstructing this old work contemplates making it a battery for heavy guns and sea-coast mortars. Timber platforms for the mortars have been procured.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.
Appropriation asked for next fiscal year $20,000 00

Castle Pinckney, Charleston Harbor, South Carolina, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This work, situated on Shute's Folly Island, about one mile east of the city of Charleston, is one of the interior works in the system of defense of the harbor. The work was commenced in 1829. In its present condition it is useless for defensive purposes, and is now in charge of the Light-House Board for light-house purposes.

An expenditure of about $10,000 will be required to adapt this work to the reception of an armament.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

DEFENSES OF SAVANNAH.

Fort Jackson, Savannah River, Georgia in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1883, *to March* 31 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This work, ocmmenced in 1842, is situated about four miles from the city of Savannah, and forms the inner line of defense for that city.

Modifications of this work, approved January 11, 1870, so as to fit it for the reception of heavy guns, were commenced in the fiscal year ending June 30, 1873, but they were suspended some years since for want of appropriations.

Operations during the past fiscal year were confined to making some repairs to the wharf at the fort, and cutting grass on the parapet and slopes of traverse magazines.

DEFENSES OF SAVANNAH—Continued.

The four wooden platforms for 15-inch guns at this fort are rotten and unserviceable.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.
Appropriation asked for next fiscal year $10,000 00

Fort Pulaski, mouth of Savannah River, Georgia, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This casemated work, commenced in 1829, is located on Cockspur Island, covers the ship-channel leading from Tybee Roads into the Savannah River, and constitutes the principal defense of the city of Savannah against naval attack.

From 1872 to 1875 the work of remodeling the demilune was carried on at intervals and nearly completed. Its gun platforms were built of timber, and two 15-inch guns were mounted on the north face. All these platforms are more or less decayed.

Nothing has been done as yet toward making the required modifications of the main work except to lay the foundations of nearly all the piers for extending the casemates on the north face.

The work done during the past fiscal year was confined to the renewal of the wooden fronts of the casemates, and of the magazine roof, and in making slight repairs to the wharf.

The seven wooden platforms for 15 inch guns in the demilune are practically unserviceable. Each of them contains a large proportion of rotten timbers; the oaken pintle blocks are nearly all thoroughly decayed.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.
Appropriation asked for next fiscal year $75,000 00

New fort on Tybee Island, mouth of Savannah River, Georgia, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—Plans have been prepared for defensive earthen works to be constructed on the north point of Tybee Island, for the double purpose of preventing the occupation of Tybee Roads by hostile vessels and defending the channel of approach to the Savannah River.

The land necessary for the work was acquired by the United States in 1875.

For several years past the northeast end of Tybee Island has been washing away. The heavy gale towards the end of August, 1881, aggravated the evil and considerably cut away the shore of the government property. The depth of water over the bar at the entrance to Tybee Roads was liable to be reduced by the sand removed from this portion of the shore and by the enlargement of the throat of the harbor.

For the protection of this shore three substantial spur-jetties, composed of log mattresses overlaid with brush and covered with riprap stone, were constructed during the fiscal year ending June 30, 1882.

An allotment of $5,000 was made from the appropriation for preser-

DEFENSES OF SAVANNAH—Continued.

vation and repair of fortifications, 1883, for the purpose of increasing the height of these jetties, and a contract for the work was awarded to J. S. Lawrence, of Savannah, Ga.

No appropriation for their construction has yet been made.
Appppropriation asked for next fiscal year..... $50,000 00

DEFENSES OF CUMBERLAND SOUND.

Fort Clinch, Amelia Island, Florida, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This casemated work, commenced in 1847, defends the entrance into Cumberland Sound, and is in an unfinished condition. A plan for modifying the work has been prepared by the Board of Engineers for Fortifications, which contemplates an armament of rifled guns and the construction of an exterior earthen battery for 12-inch rifled guns.

During the past fiscal year operations were carried on with a view of further protecting the site of the fort. Four of the five spur-jetties, built in 1881, which had been made only to lengths of from 220 to 243 feet each, were extended seaward, and now measure, each, from 300 to 312 feet in length. The central jetty, next to the sea-wall of the fort, was raised to a higher level at its upper end, to promote the building out of the high-water line in the vicinity.

Two new spur-jetties were built to the west of the existing ones, as it had been observed that the shore continued to be washed away on that side. These new works were constructed of riprap stone supported by platforms of heavy logs, like those previously built; the length of each is about 300 feet. One of the new jetties is located about 600 feet west of the nearest of the older jetties; the other one 450 feet farther west.

These new works were completed in April, 1883. They appear to have arrested the washing away of the beach, and some sand filling has taken place, although to no great extent.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiiscal year for the same reason.
Appropriation asked for next fiscal year..... $50,000 00

DEFENSES OF SAINT AUGUSTINE.

Fort Marion, Saint Augustine, Florida, in charge of Col. Q. A. Gillmore, Corps of Engineers, except from November 28, 1882, *to March* 31, 1883, *when temporarily in charge of Capt. J. C. Post, Corps of Engineers.*—This work is intended to defend the harbor and city of San Augustine. It was built by the Spainards, and was called by them San Marco. It was essentially completed in the year 1756, its construction having extended through a period of more than one hundred years. It is built of coquina, a natural shell concrete found in the vicinity. No money has been expended by the United States for the maintenance of the work, or in arresting the progress of ordinary deterioration and decay, for the reason, doubtless, that the water battery constructed in front of it in 1842–'43 will, if suitably armed, furnish a sufficient defense for this locality. The main work is not suitable for an efficient defense.

Under special instructions from the Department some repairing work was done during the past fiscal year, permission having been granted

DEFENSES OF SAINT AUGUSTINE—Continued.

to a party of French officers to occupy the fort for the purpose of observing the transit of Venus.

The wooden bridge across the main ditch, and the bridge over the demilune ditch, were renewed; new windows were put in the window openings on the parade front, and the windows of three casemates were provided with shutters. These casemates and the sallyport received new wooden floors, and were plastered and whitewashed. Doors and frames were put in all door openings of the parade wall where necessary. The stairs leading from the terreplein to the watch-tower on the northeast bastion were rebuilt. A cement paste was laid over the sallyport and four casemates.

The wood work of all doors and windows, and the posts and hand-railing of the bridges, were painted.

Should it be desired to restore old Fort San Marco, both main work and demilune, to the condition substantially in which it was left by the Spaniards, it can be done, so far as it is possible to attain this object, and omitting all preparations for an armament, for from $12,000 to $14,000.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

DEFENSES OF KEY WEST.

Fort Taylor and batteries, Key West, Florida, in charge of Capt. W. H. Heuer, Corps of Engineers.—These works, comprising the main casemated work on a submarine foundation and earthen batteries on the island, are for the defense of the important harbor of Key West. The main work was commenced in 1844.

The exterior earthen batteries for heavy guns, projected by the Board of Engineers for Fortifications, and commenced in 1872, were left incomplete at the close of the last fiscal year, for which an appropriation for this work was made (1875–'76).

The estimated cost of these batteries is $240,338.

During the year, for want of any appropriations, no work was done to the fort proper or batteries.

The barracks and quarters within the fort are in bad order. To put them in good order will cost about $15,000.

The two Martello Towers are in fair condition. They were constructed in the early part of the war on private land, the title to which has never been acquired by the United States.

For certain necessary repairs to the main work and buildings, for continuing the construction of the exterior batteries for modern guns of large caliber, for building new gun-platforms, and for purchasing the land on which the Martello Towers stand, an appropriation is recommended.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year:

For repairs of buildings, and continuing the construction of the exterior batteries	$67,000 00
For acquisition of sites of the two Martello Towers, by purchase or condemnation	9,000 00
	$76,000 00

DEFENSES OF THE HARBOR OF DRY TORTUGAS.

Fort Jefferson, Garden Key, Tortugas, Florida, in charge of Capt. W. H. Heuer, Corps of Engineers.—This casemated work, commenced in 1846, perfectly commands the admirable harbor lying in the heart of this group of keys.

During the past fiscal year operations were restricted to caring for the public property and buildings.

The modifications of this work, designed by the Board of Engineers for Fortifications, are in an incomplete condition. It is, however, desired to mount some heavier guns than those for which the work was originally planned, for use in case of emergency, and it is proposed to erect a few stone platforms for them. For this and some necessary repairs an estimate is submitted.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year..... $28,000 00

DEFENSES OF PENSACOLA HARBOR AND NAVY-YARD.

Fort Pickens, Pensacola Harbor, Florida, in charge of Maj. A. N. Damrell, Corps of Engineers.—This casemated work, commenced in 1828, with Fort Barrancas and the proposed new batteries near the site of Fort McRee, constitute the defenses of the town and harbor of Pensacola, and the navy-yard at Warrington. It is situated near the west end of Santa Rosa Island, and is at present the only work of defense to the entrance and main channel to Pensacola Harbor.

Plans for the modification of this work and the construction of exterior sand batteries for heavy guns were prepared by the Board of Engineers for Fortifications when Bastions C and D were modified, but since 1876 no appropriations have been made for this work, and operations have therefore been confined to the preservation and repair of the buildings and works, and to the care of the public property appertaining to the same.

The condition of the fort and buildings remains the same as reported the previous year.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year..... $75,000 00

Fort Barrancas and redoubt, Pensacola Harbor, Florida, in charge of Maj. A. N. Damrell, Corps of Engineers.—These works, commenced in 1839, are situated on the north bank of the entrance of Pensacola Harbor, opposite to Fort Pickens, and are intended for defense of this entrance and protection from land attacks.

For many years operations at this work were confined to necessary repairs to masonry, slopes, and wood-work, until 1874, when the construction of four front pintle platforms for mounting new ordnance was commenced; but work was suspended before much progress was made, none of the platforms having been completed. Since that time operations have again been confined to ordinary repairs.

DEFENSES OF PENSACOLA HARBOR AND NAVY-YARD—Continued.

Plans and estimates for the construction of an exterior battery on the bluff west of the fort have been prepared by the Board of Engineers for Fortifications, but so far no appropriations have been made and no work has been done.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.
Appropriation asked for next fiscal year..... $50,000 00

Fort McRee, Pensacola Harbor, Florida, in charge of Maj. A. N. Damrell, Corps of Engineers.—This fort, situated on the west side of the main ship-channel to Pensacola Harbor, commenced in 1836, has been a ruin since the late war, and the greater portion has been washed away by the encroachment of the sea upon its site.

Plans for the construction of batteries for the heaviest modern guns and mortars near the site of the old fort, to co-operate with Fort Pickens and the works at Barrancas in the defense of this important harbor, have been prepared by the Board of Engineers for Fortications, but as no appropriation has been made for them no work was done upon them.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.
Appropriation asked for next fiscal year..... $50,000 00

DEFENSES OF MOBILE.

Fort Morgan, eastern entrance to Mobile Bay, Alabama, in charge of Maj. A. N. Damrell, Corps of Engineers.—This casemated fort, commenced in 1819 and completed in 1833, is situated at Mobile Point, on the east side of the main ship-channel to Mobile Bay, and as it commands this channel from the outer bar to the lower anchorage, and forms, with Fort Gaines on the west side of the channel, the outer line of defenses to the harbor and port of Mobile, its site is of great importance, but will not be of much value as a defensive work until the contemplated water batteries for heavy ordnance, along the western and southern shore are completed. As stated in former reports, the construction of these batteries was commenced in September, 1875, but work had to be suspended in April, 1876, the amount appropriated being exhausted; and as no appropriations have been made since, this work has not been resumed.

The sea-wall, completed to a distance of 1,300 feet south of the wharf in 1878, for the protection of the site of the fort, was badly injured by the heavy storms in December, 1879, by being partially undermined near its southern end; and a brush apron, with stone ballast, was put in front of that section of the wall.

After a heavy gale during February, 1881, it was found that the water almost along the entire length of the wall had deepened to such an extent as to threaten its destruction by undermining, and for its preservation it became necessary to construct a brush and rock apron in front of the wall; nearly one-half of this work was done in 1882. Under an allotment of $3,767 made for the present fiscal year for the completion of the apron in front of sea-wall commenced during the previous year, 605 running feet of mattresses were put in and well ballasted with rock.

DEFENSES OF MOBILE—Continued.

A new wire fence was put up around the fort and general repairs made to fort and buildings and the public property was properly cared for.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year..... $75,000 00

Fort Gaines, Dauphin Island, Alabama, in charge of Maj. A. N. Damrell, Corps of Engineers.—This work, commenced in 1848, is, with Fort Morgan, on the opposite side of the main entrance to Mobile Harbor, designed to command that entrance and the lower fleet-anchorage. It needs complete modification to adapt it to the use of modern heavy guns, and plans therefor have been prepared by the Board of Engineers for Fortifications; but no appropriations having been made for this work, the fort remains in the condition as reported in former reports.

Operations during the year were confined to preservation and repair of buildings, cleaning and repairing drains, and to the care and preservation of the public property.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year..... $50,000 00

DEFENSES OF MISSISSIPPI SOUND.

Fort on Ship Island, in charge of Maj. A. N. Damrell, Corps of Engineers.—This casemated fort, commenced in 1862, is located at the west end of Ship Island, on the east side of Ship Island channel, and is designed for a fortified maritime depot of coal, provisions, &c., and for the defense of the navigation of Mississippi Sound and the approaches to New Orleans from the eastward.

During heavy easterly gales in September and October 1½ feet water was found all along the southern and western exposure of the fort. Three jetties were constructed with heavy rock ballast on brush mattresses during the fiscal year ending June 30, 1882, on the south and west of the fort, and their effect has proved quite satisfactory. In addition, a plank bulkhead was built east of the fort to prevent the sea from washing across the island at that point.

During the months of May and June of the present fiscal year work was continued on the construction of stone jetties. Jetties Nos. 1 and 2 were extended and repaired with mattresses and rock ballast. On account of the scarcity of ballast the timber bulkhead, constructed last year, was extended west to Jetty No. 1, and east to the sand hills abreast of the old stockade.

A timber jetty filled in with brush and sand was erected 80 feet east and parallel with jetty No. 1 for the protection of the southeast corner of the fort.

With the exception of the above work, operations during the year were confined to ordinary repairs and to the care of the public property.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

DEFENSES OF NEW ORLEANS.

Fort Pike, Rigolets Pass, Louisiana, in charge of Maj. Amos Stickney, Corps of Engineers.—This casemated work, commenced in 1819, is located on the south side of the Rigolets, a pass connecting Lake Pontchartrain with Mississippi Sound and the Gulf of Mexico. It was designed to guard the extreme eastern approach to New Orleans available for vessels drawing 7 feet or less.

During the late civil war, while in the possession of the Confederates, with the aid of obstructions in channel, it served to prevent predatory incursions of light-draught steam gunboats of the United States Navy into Lake Pontchartrain, which, no doubt, but for it, would have cut off direct communication by the lake and by rail between New Orleans and the country east of the Mississippi River.

Since 1862 the work has been kept in about the same condition it was then, except as to armament and garrison, both of which have since been removed.

A project for the modification of this work, to adapt it for the reception of modern ordnance, was prepared by the Board of Engineers for Fortifications in 1870, but no appropriation has been made therefor.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year $24,000 00

Fort Macomb, Chef Menteur Pass, Louisiana, in charge of Maj. Amos Stickney, Corps of Engineers.—This work, commenced in 1822, is located on the south side of the "Chef Menteur," a pass connecting Lake Pontchartrain with Lake Borgne and the Gulf of Mexico. It covers the approach to New Orleans of vessels drawing 4 feet or less *via* the pass and Lake Pontchartrain, and also the practicable approach of a land force from the pass *via* the "Gentilly Ridge" and the line of the New Orleans, Mobile and Chattanooga Railroad, which crosses the pass but a few hundred yards from the fort.

A project for the modification of this work, to adapt it for the reception of modern ordnance, was prepared by the Board of Engineers for Fortifications in 1870, but no appropriation has been made therefor.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year $24,000 00

Tower Dupré, Lake Borgne, Louisiana, in charge of Maj. Amos Stickney, Corps of Engineers.—This tower, commenced in 1830, is located at the mouth of Bayou Dupré, a bayou connected with Lake Borgne and heading near the Mississippi River, about 12 miles below the city of New Orleans. It is one of the system of works designed to command the approaches to New Orleans from Mississippi Sound.

It was mainly through this bayou that the British forces approached New Orleans in 1814.

About 1873 and 1874 the bayou was converted into a canal by widening and straightening it in places, and by excavation extending to within a few hundred feet of the Mississippi River. A pier was also extended into the lake. Vessels drawing 4 feet or less can now easily pass from the Gulf of Mexico *via* this canal to its end, near the river.

DEFENSES OF NEW ORLEANS—Continued.

Since the late civil war but little has been done to this work, and for the past few years nothing has been done. The tower is at present in a fair state of preservation. The parapet of the battery has nearly all been removed and there is no armament. In case of necessity the work can be put in condition in a few days to receive a section of a battery of rifled field guns and a suitable garrison.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

Battery Bienvenue, Lake Borgne, Louisiana, in charge of Maj. Amos Stickney, Corps of Engineers.—This battery, commenced in 1826, is situated in the sea marsh at the junction of the two main branches of Bayou Bienvenue, and about three miles from the mouth of the bayou. It was designed to guard against boat expeditions from Lake Borgne *via* this bayou to attack New Orleans in the rear of the lower portion of the city.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

Tower at Proctorsville, Lake Borgne, Louisiana, in charge of Maj. Amos Stickney, Corps of Engineers.—This work, commenced in 1856, is one of the system of works designed to command the approaches to New Orleans from Mississippi Sound. No work was done during the past fiscal year.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

Fort Jackson, Mississippi River, Louisiana, in charge of Maj. Amos Stickney, Corps of Engineers.—This work, commenced in 1822, is situated on the right (west) bank of the Mississippi River, at what is known as the Plaquemine Bend, about 70 miles below the city of New Orleans.

Together with Fort Saint Philip, situated on the opposite bank of the river, it was intended to serve in the defense of the very important port of New Orleans and its surrounding country against attack of a hostile fleet attempting their capture by way of the river.

It is an inclosed casemated work, with masonry scarps and new exterior earthen batteries, which are in an incomplete condition.

The levees for the protection of the fort and the reservation being inefficient, from lack of height, damage by overflow, and boring of crawfish, the fort and surrounding ground was flooded during the high water.

An allotment of $5,926.21 was made December 1, 1882, for construction and repair of the levees, and a contract was entered into for that purpose, but owing to high-water has not been completed. It is contemplated to complete this levee work during the coming season.

For needful repairs to the work, completing new earthern batteries, and for continuing preparations for mounting an armament of heaviest caliber, the modifications of this work, designed by the Board of Engineers for Fortifications, to adapt it for the use of modern heavy ordnance, being incomplete, an appropriation is asked.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.
Appropriation asked for next fiscal year $25,000 00

Fort Saint Philip, Mississippi River, Louisiana, in charge of Maj. Amos Stickney, Corps of Engineers.—The location and purpose of this work,

DEFENSES OF NEW ORLEANS—Continued.

which was commenced in 1841, are sufficiently described in the preceding report on Fort Jackson.

It is fully as important to be maintained and properly armed as Fort Jackson. Although the latter is the larger work, the position of the former is more advantageous.

It is an inclosed barbette work, with masonry scarp and new exterior earthern batteries, which are in an incomplete condition.

The levees for the protection of the fort and reservation from river floods are inefficient. It was intended to allot a sum sufficient to construct and repair these levees, a survey for which was made, but the amount of funds available would not permit it, and necessitated postponement until another appropriation was made. This work will be done during the coming season.

For needful repairs to the main work, and for continuing the construction of the exterior earthen batteries of heavy guns which have been designed by the Board of Engineers for Fortifications, and which are yet incomplete, an appropriation is recommended.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year $25,000 00

Fort Livingston, Barataria Bay, Louisiana, in charge of Maj. Amos Stickney, Corps of Engineers.—This work, commenced in 1842, is located on the west end of Grande Terre Island, at the entrance to Barataria Bay, and guards the western line of approach to New Orleans offered by the bay and the bayous and canals connecting the bay with the Mississippi River opposite New Orleans. It also secures the anchorage in the bay as a harbor of refuge for coasting or other light-draught vessels in time of war.

No appropriation having been made, no work was done at this fortification during the last fiscal year.

No work is contemplated during the current fiscal year beyond its protection, preservation, and repair, as far as possible with the general appropriation made for this purpose.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

DEFENSES OF GALVESTON.

Batteries at the entrance to the harbor of Galveston, Texas.—The object of the earthen batteries of heavy guns, recently designed by the Board of Engineers for Fortifications, to be placed on Pelican Spit, Galveston Island, and Bolivar Point, is for the defense of the entrance to the harbor of Galveston, a harbor rapidly increasing in commercial importance. No appropriation for the construction of these works has yet been made.

Appropriation asked for next fiscal year $50,000 00

DEFENSES OF SAN DIEGO HARBOR.

Fort at San Diego, California, in charge of Col. S. C. Stewart, Corps of Engineers.—This earthwork, situated in rear of Ballast Point, commands the channel at the entrance to the bay and harbor of San Diego.

DEFENSES OF SAN DIEGO HARBOR—Continued.

The first and only appropriation for it was an appropriation of $50,000 for the fiscal year 1873–'74; under it work was commenced in 1873, and considerable progress was made, but in its present unfinished state this battery is utterly worthless for defensive purposes. Its position wholly controls the entrance to the important harbor and bay of San Diego, every vessel going in necessarily passing close to the work.

The embankment of the faces of the battery was raised to the level of the parade, and the concrete masonry of the walls of one service magazine built to the spring of the arch. The watchman in charge of the public property has made the repairs to embankments which have been required.

To complete this work so that it may receive its armament of fifteen heavy guns requires the construction of everything above the level of the parade; that is, of parapets, magazines, terrepleins, breast-height walls, platforms, and communication. It is estimated about $135,000 will be required for these. An appropriation of $70,000, to be applied to the masonry of magazines, breast-height walls, and gun platforms, and so much of the earthwork connected therewith as possible, is asked for the year ending June 30, 1884.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year $70,000 00

DEFENSES OF SAN FRANCISCO, THE NAVY-YARD AT MARE ISLAND, AND THE ARSENAL AT BENICIA.

Fort Winfield Scott, entrance to San Francisco Harbor, California, in charge of Lieut. Col. C. S. Stewart, Corps of Engineers.—This casemated work, commenced in 1853, and its exterior earthen barbette batteries, commenced in 1870, form the defenses of the south side of the Golden Gate, the entrance to San Francisco Harbor.

The main casemated work is occupied by a garrison. During the past fiscal year, under the direction of the Quartermaster's Department, changes have been made in the sewerage of the casemate quarters; a one-story frame building for officers' quarters has been put up exterior to the fort; a portion of the piles of the wharf destroyed by the teredo has been replaced, damages to it made good, and considerable labor expended in widening and improving the roadway leading to the garrison along the foot of the bluffs.

The engineer watchman has painted the iron work of the embrasures, and the railings of the casemates and of the barbette tier.

The disintegration of the mortar in joints of scarps and facings of piers and soffits of arches is still going on. At some future day the whole of the brick-work will have to be repointed. Many of the bricks in scarps are being eaten away by the influence of weather and of the sand driven against them by the strong and continuous winds prevailing here. Each year makes more apparent the progress of deterioration. The casemates are in fair condition.

The sea-wall is in good order. Though the large stones of the apron at the foot of this wall have, as heretofore reported, been moved at some points, no great change seems to have taken place in it during the

DEFENSES OF SAN FRANCISCO, THE NAVY-YARD AT MARE ISLAND, AND THE ARSENAL AT BENICIA—Continued.

past year, and none is likely to occur unless from the action of a series of extraordinarily heavy gales with powerful seas.

The magazines are in as good condition as heretofore. Annual wear and tear excepted, the general state of the work is essentially as it has been for the past few years.

Earthen barbette batteries exterior to the fort.—There being no special appropriation for these, the watchman has kept the iron work of the mortar platforms lacquered; has repainted magazine doors; cleaned out and repaired drains; mowed portions of the slopes; has repaired fences and buildings, and whitewashed the latter. These are now very old and much decayed. Considering these batteries have now been exposed, in an unfinished state, to the action of the weather for several years, they are in fair condition.

Two platforms in addition to those which are mounted are ready to receive their guns. Six others have been constructed, but owing to the settlement of the terreplein, in deep filling, two of these are not in condition to have the guns mounted. The pintle-blocks for eight platforms are in position, and the concrete foundations for six more have been built. Three positions for heavy guns are ready for platforms, and fourteen more have been begun. Thirteen traverse magazines are ready, and sixteen more can be used when needed. Twelve timber platforms for heavy mortars are in position. The timber of these is decaying.

To complete the batteries for their armament of heavy guns will require, it is estimated, about $120,000. An appropriation of $100,000 is asked for the fiscal year ending June 30, 1884, to be applied toward the finishing of thirty platforms for heavy guns, and the parapets, traverses, magazines, terrepleins, and communications pertaining thereto.

No work upon these batteries has been done since 1876, for want of funds, and the importance of an efficient protection of the city of San Francisco, the navy-yard at Mare Island, and the United States arsenal at Benicia, warrants an early and adequate appropriation therefor.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year $100,000 00

Fort at Lime Point, San Francisco Harbor, California, in charge of Lieut. Col. George H. Mendell, Corps of Engineers.—The system of works projected for the defense of the Golden Gate from the northern shore consists of a casemated work to be built at Lime Point, and detached earthen barbette batteries on Point Cavello, on Lime Point Ridge, at Gravelly Beach, and on Point Diablo.

Some work was done in 1866, 1867, and 1868 on the excavation of the site of the casemated work, but it remains incomplete. The Point Diablo Battery was never begun. The other barbette batteries were under construction from 1870 to 1876, but are incomplete, with the exception of the Gravelly Beach Battery.

These works have been under the care of keepers during the past year, who have kept the parapets and platforms in good order. Where wood was used in revetments and platforms, it is more or less decayed. The magazines in each of the batteries are dry and in good condition.

Twenty-four gun-platforms and breast-height walls for seven guns are

DEFENSES OF SAN FRANCISCO, THE NAVY-YARD AT MARE ISLAND, AND THE ARSENAL AT BENICIA—Continued.

required to complete the batteries already built. It is estimated that it will require $100,000 to do this work and to rebuild the wharf and water-tank, with other repairs. Eighty thousand dollars can be profitably used in the coming year. The estimate does not include the Point Diablo Battery, approved by the Secretary of War, which battery has never been commenced.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year..... $80,000 00

Fort on Alcatraz Island, San Francisco Harbor, California, in charge of Lieut. Col. George H. Mendell, Corps of Engineers.—Alcatraz Island lies in the harbor of San Francisco, two miles inside its entrance, in a very advantageous position for the defense of the channels on every side of it.

In 1870 the work of remodeling the defenses of this island to adapt them to modern ordnance—this work consisting of the construction of heavy earthen batteries—was commenced and carried on for a few years, when it was suspended for want of funds. The last appropriation ($25,000) was for the fiscal year 1875–'76, although there was some work done, mostly by the military prisoners confined on the island, in 1877.

During the year the embrasure irons of the casemated barrack were painted. Repairs were made on the engineer buildings and fences. The grass on the slopes of the batteries was cut, and the batteries and drains kept in good order.

Storage for torpedoes was prepared in the casemated barrack by arranging the drainage of the unfinished building so that it could not reach the casemates below where the torpedoes are to be stored.

The condition of the batteries and magazines is as good as at the beginning of the year, the magazines being dry with one exception, and the forms of the parapets and slopes are well preserved.

No appropriation having been made, no work was done at this fortification during the last fiscal year beyond its protection, preservation, and repair, as far as was possible with the general appropriation made for this purpose, and no other work is contemplated during the current fiscal year for the same reason.

Appropriation asked for next fiscal year..... $50,000 00

Fort Mason, San Francisco Harbor, California, in charge of Col. C. S. Stewart, Corps of Engineers.—During the late civil war two temporary earthen batteries were built on this point.

In the east battery the timber platforms are decayed as well as the wood-work of the magazines, part of which has caved in. This battery is unserviceable.

Projects for new earthen batteries of heavy guns and mortars for the occupation of this important point in the second line of defense for the bay and harbor of San Francisco have been prepared by the Board of Engineers for the Pacific Coast.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

Batteries on Angel Island, San Francisco Harbor, California, in charge of Col. C. S. Stewart, Corps of Engineers.—The three earthen batteries

on this island were built during the late civil war for temporary use. The timber platforms and the timber magazines are decayed, and nearly all the gun-carriages have been condemned.

The batteries are practically unserviceable.

Barbette earthen batteries for the heaviest guns have been planned by the Board of Engineers for the Pacific Coast, to occupy the most valuable positions on the island which bear on the channels leading to the upper part of the bay, to the navy-yard at Mare Island, and to the arsenal at Benicia.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

DEFENSES OF THE COLUMBIA.

Defenses at the mouth of the Columbia River, Oregon, and Washington Territory, in charge of Capt. C. F. Powell, Corps of Engineers.—The defenses consist of Fort Stevens, an inclosed earthwork at Point Adams, Oregon, on the south side, and the earthen batteries at Fort Canby, Cape Disappointment, Washington Territory, on the north side.

The works command the channels at the entrance, the ship channels leading to Astoria, and the anchorage in Baker's Bay under the lee of the cape on the north.

The channels to the river have natural depths of 19 to 24 feet at low water, and a mean rise of tide above this plane of 7½ feet.

These defenses are field works in character; they were built hastily during the late civil war in anticipation of complications with foreign powers. On account of the decay of the wooden platforms, breast-height walls, and magazine timbers, the works are of little use in their present condition except for drill purposes.

Fort Stevens.—During September and October, 1882, minor repairs were made to the drain and bridge of the moat; a powder-house was built; 130 linear feet of the plank wall of the interior slope of the parapet on the north face, which had become badly decayed, were removed and replaced by new planking.

During April and May, 1883, the remainder of the breast-high plank walls on the north face and at the northeast (15-inch gun) salient, 221½ linear feet, were renewed by a construction similar to that made during the previous fall, except that the posts are 4 by 8 inches. Old and decayed plank walls on the west and bastion faces, for 360 linear feet, were removed, and a revetment of marsh sod with a backing of muck and loam laid instead. The revetment of the interior slope of the parapet on all of the land and unarmed fronts is now of marsh sod. The portion laid a year and a half ago is yet in a fair condition; the new sod is expected to do better on account of larger filling behind with muck and loam.

The inexpensive brush works which were placed on the beach last year in front of the channel (northeast) salient and across the outlet of the slough on the western side of the fort, for protection against erosion, have, so far, effectually answered the intended purpose.

The platforms, with one exception, are in an unserviceable condition. The service magazine requires extensive repairs.

Fort Canby.—No operations were conducted during the year. No change of armament has occurred; an 8-inch rifle received during last

DEFENSES OF THE COLUMBIA—Continued.

year, and for which a platform was then made at the center battery, has been moved to that battery, but is not yet mounted.

The service magazines at the left and center batteries are useless without being rebuilt. The magazine at the right battery requires small repairs.

Many of the platforms of the batteries are in an unserviceable condition.

No appropriation was made for the fiscal year ending June 30, 1884.
No appropriation asked for next fiscal year.

BOARDS OF ENGINEERS.

THE BOARD OF ENGINEERS.

The Board of Engineers stationed at New York City consisted of Col. Z. B. Tower (until January 10, 1883), Col. John Newton, Lieut. Col. Henry L. Abbot, Lieut. Col. Cyrus B. Comstock (since August 13, 1882), and, when so ordered, the officer in charge of the work under consideration.

Col. Z. B. Tower, President of the Board, was retired upon his own application from active service on the 10th of January, 1883. He had been a member from its institution in 1867, and his matured experience and familiar acquaintance with the great changes which have occurred in artillery and fortifications during late years, made his services of special value and gave to his opinion great weight with the other members of the Board.

The Board has been engaged in the duties which have from time to time been referred to it, and has submitted the following report of its operations:

Coast defenses.—The various reports of the Board of Engineers for Fortifications during the past fourteen years have set forth with more or less completeness its views upon the measures necessary to secure the harbors of the United States against maritime attack. At present a brief exposition only of this subject is required.

Quoting from the last annual report:

> First. That our defense for many years must depend upon the finishing of barbette batteries designed long since, but with such modifications as will adapt them to the reception of the 12-inch rifled gun recently proposed, with its enlarged carriage, and at the same time give greater security to the magazines. Second. To make ready without delay to apply our system of torpedoes to all harbors by preparing bomb-proof electrical operating rooms and deep masonry galleries extending therefrom to the low-water line, needed for that purpose.
>
> The above are the two prominent features of our system of defensive works requiring prompt attention, a system which, though a preliminary one, in part, has the merit of being comparatively inexpensive.

The Board has not overlooked the necessity for the use of armor in our defensive system to cover the emplacements of the largest and most powerful guns known, and for this purpose has prepared plans for two double-turreted iron forts, one for each shore of the Narrows at the south entrance to New York Harbor. The Board has also suggested the application of the turret system to Boston and other harbors of leading commercial interest.

The turrets would form a necessary adjunct to the barbette system, and no naval ship yet built or designed could remain under their close fire long enough to do them damage.

The plans of the electrical operating rooms and cable galleries for the most important of our sea-coast works have been prepared, and only await for their construction the necessary appropriations.

The designs for barbette batteries, prepared twelve or fourteen years ago, in view of the more powerful armament of ships of war, and of the greatly increased penetration of projectiles, demand early attention looking to the modification of those now unfinished. This important matter has for some time engaged the attention of the Board, and although the study of the subject is not yet finished, an early report may be anticipated.

The guns and carriages of a barbette battery are exposed to damage and destruction from the distant fire of ships of war lying beyond the armor-piercing range of our forts, and at closer distances the fire of shell, shrapnel, &c., may be effective in driving away the gunners and silencing the battery.

A new and adverse element has been added by the use in ships of machine guns, and there are positions and circumstances easy to be conceived in which the shower of bullets from these guns might prove fatal to the service of a barbette battery.

These considerations, looking also to the fact that many barbette batteries, from the nature of the site, have but a small elevation above the water level, point to the necessity of some arrangement by which the guns may be loaded under the shelter of the parapet, so that the men and guns may not be seen save during the act of pointing and firing.

The Board has been constant in its views and recommendations to this end, and any arrangement of carriages, &c., which the department in charge of this branch of the service may project to give adequate protection to guns and gunners could be readily adapted to the batteries.

It is well known that our coast, with its important ports, is virtually defenseless against a modern naval attack, and proper anxiety for the care of the national honor and interests, which such a state of things should suggest, may perhaps be quieted by the impression that upon the approach of hostilities our vast resources would enable us to improvise some sort of adequate defense.

For many years no appropriations have been made for the modification of our forts and the construction of the barbette batteries designed by the Board of Engineers, so that this part of the country's defense is very incomplete.

The manufacture of heavy rifled guns by the Ordnance Department was not provided for until 1880, when Congress appropriated for the construction of four 12-inch rifled guns. The manufacture of these has been suspended. There are in this country no rifles mounted of a size sufficient to combat heavily-armored ships, nor has any type for such guns yet been adopted.

Upon the approach of war it would be impossible to obtain in season from abroad the requisite calibers and numbers of guns, and our own establishments, from want of encouragement, are not now prepared to do the work with the promptitude necessary for any useful effect.

The Chief of Ordnance in his report stated that it would require sixteen months for the making of the first 12-inch rifle authorized, and two years for the completion of the four.

In Italy fourteen and one-half months were consumed in the manufacture of the first 100-ton gun of cast iron with steel tube. The first 80-ton gun made in England required sixteen months.

Although the periods given above have probably since been much

reduced, is it to be credited that in the undeveloped state of our gun manufacture we could surpass these first efforts of Italy and England?

In addition to the period required for the manufacture of heavy guns, a considerable time would be necessary for the construction of proper beds for mounting them for service.

Again, without heavy rifles in sufficient numbers, the lines of torpedoes planted for the protection of our harbors could not be defended against an attempt of the enemy to remove or countermine them.

To conclude, if the near approach of war should find our coast in its present condition, there would be no probable chance of resisting a modern naval attack made, as the interest of an enemy would dictate, with force and celerity.

Torpedo defense.—The appropriation of $100,000 made for the fiscal year 1882–'83 for providing materials to defend our coasts with submarine mines has been expended, as recommended by this Board, chiefly in the purchase of torpedo cases for obstructing the approaches to San Francisco. This harbor is especially open to attack by sea, and its capture would entail consequences so serious that adequate preventive measures should no longer be neglected. The prompt expenditure of not less than half a million dollars in the purchase of imperishable torpedo material for storage in this harbor alone is demanded by the present condition of the defensive works.

To successfully defend our coasts with torpedoes it is absolutely necessary at the outbreak of war to have (1) a suitable supply of the material on hand; (2) the needful casemates, cable galleries, &c., in our forts for operating the mines when planted; and (3) a sufficient force of Engineer soldiers so well instructed in their duties as sea-miners as to be able to place the torpedoes in position before the enemy's fleet can arrive in front of any of our chief sea-ports.

The first of these three needs has received recognition from Congress in the annual grant of small sums for the purchase of materials, but the second and third conditions, which are equally important to the security of the country, have been quite overlooked. An appropriation of $200,000 for constructing the needful casemates and cable galleries in our more important harbors on the Atlantic coast is therefore strongly recommended for the coming year; also, the increase of the Engineer Battalion to its legal organization of 752 men from the present authorized force (20[illegible] men) imposed by the limitation of the Army to 25,000 men and the need for troops in the Indian country. Both of these recommendations were so fully set forth in our annual report for last year that it seems only incumbent upon us to again mention them as most urgently worthy of attention.

The investigations for further developing the subject of defensive submarine mining have been continued, as heretofore, at Willets Point, by Lieutenant-Colonel Abbot.

In the matter of explosives, as the Giant Powder Company—which holds the right to the patent in this country—is not yet ready to supply explosive gelatine, and as it is regarded important to continue our trials with that substance without further delay, a supply of 2,000 pounds was ordered from the Nobel's Explosives Company, Limited, of Glasgow, Scotland. This was to be shipped by a sailing vessel in May, 1883, and is expected shortly to arrive.

Careful ring trials (thirty-eight shots) were made in the autumn of 1882 to test the gun-cotton and tonite supplied by the Tonite Powder Company of San Francisco. They showed the former to be the equivalent of the best English manufacture in explosive intensity; and the latter

to be about 5 per cent. inferior to the gun-cotton by weight, both fired under water.

A thorough ring analysis (fifty-seven shots) was also given to a new American explosive—rack-a-rock—sold by the Rendrock Powder Company of New York. This explosive consists of two ingredients, essentially potassium chlorate and nitro-benzol, which are mixed only when required for firing. As neither is separately explosive, the powder is absolutely safe to transport, and when fully detonated it is the equivalent of gun-cotton in explosive intensity under water. Strong primers are required to develop its full power. In appearance, when mixed, it is a solid like dark red clay, having a specific gravity of about 1.7. Its cost is small, and it is worthy of the attention of officers engaged in blasting operations.

The usual electrical cable tests have been continued during the year, and a few miles of Henley's ozokerited India-rubber cable have been purchased for service and for a further trial of its endurance when stored in air.

A large group of mines planted in the channel off Willets Point have been kept under frequent tests during the entire year.

The subject for most elaborate investigation, however, has been the perfecting of Sims's movable fish torpedo, for use in connection with our stationary mines. This study has been in progress since 1880. During the past year attention has been chiefly devoted to testing the modifications in the model, suggested by the trials of 1881; to testing the strength of the torpedo to resist concussion against floating obstructions; and to determining by trial whether the provisions to neutralize the fire of artillery and machine guns are effective. Entirely satisfactory results have been reached in each of these respects.

In improving the electrical motor but little has been accomplished, owing to the failure of Mr. Edward Weston, electrician of the United States Electric Lighting Company, to keep his engagements. During the years 1880 and 1881 a series of very careful experiments were made at Willets Point to discover the principles which govern this new mode of transmitting power, then by no means so well understood as at present. Mr. Weston had constructed the original motor for Mr. Sims, and early in February, 1882, after being informed of its defects and of the details of the measurements at Willets Point, he agreed to make a new motor, of which the field magnets were to be arranged on the shunt instead of the series principle, and which should be ready for trial before the close of the working season of that year. This he totally failed to accomplish. In the mean time, upon his recommendation, Lieutenant-Colonel Abbot had purchased one of his new 15-light arc dynamos (shunt) for use as the new generator, and had discovered by measurement that it failed to supply the requisite electro-motive force. In February, 1883, Mr. Weston agreed to correct this defect in the dynamo, and again promised to construct the experimental motor upon certain electrical specifications supplied by Lieutenant-Colonel Abbot, both instruments to be delivered early in the spring; but at the end of March he suddenly declined to have anything more to do with the motor. Lieutenant-Colonel Abbot states that this vacillation has cost the Government one, and probably two, working seasons in the development of this torpedo; but, as the requirements to be fulfilled have been fully studied out, it is believed that at a new establishment the work will be more promptly and more skillfully performed.

As stated above, an experimental study was given to the Weston 15-light arc machine (shunt) in November, 1882, and it has since been re-

placed by a 20-light machine better suited to the work we have to do. A few measurements were also made of the new Schuyler dynamo at Hartford. They showed that, although not so well suited to our special problem as the Heffner Atteneck arrangement (after which the Weston machine is patterned), this instrument is nevertheless worthy of careful study as a light generator. It presents some interesting features in an economic point of view.

In respect to Sims's torpedo, only the electrical problem demands further study. The form and dimensions of the boat and of the float, and the best mode of uniting them have been experimentally determined. During the past year Mr. Sims has completed one and is now making two more torpedoes for the Government (omitting the motors for the present), each capable of carrying 11,000 feet of cable and about 300 pounds of dynamite. The speed thus far attained with the 1-mile boat is about 10 miles per hour, and when the motor is perfected a marked increase is expected. The invention supplies a useful auxiliary to our stationary mines, and should form a part of the material provided for the defense of all our more important harbors. Except for the vexatious delays and failures above reported, the pattern of motor would probably now be adopted.

The final report of Lieutenant-Colonel Abbot upon the details of the torpedo investigation at Willets Point is now complete to date, except in respect to the electric-light experiments still in progress. The first three chapters have been published as Professional Papers No. 23 of the Corps of Engineers. The remainder is of a confidential nature, and should not be made public at present.

The Board has also submitted reports on the subject of fortifications, as follows:

1882. December 14. Recommending the construction of a war model of Sims's electrical torpedo boat.

1883. January 9. Submitting records of practice in Europe with heavy rifled guns.

January 29. Recommending an appropriation for the construction of controllable fish torpedoes.

April 2. Submitting project for the expenditure of appropriation of $75,000 for torpedoes for fiscal year 1883–'84.

April 9. Upon defense of San Francisco Harbor by means of torpedoes, with drawings, estimates, &c.

April 13. Upon invention of Lieutenant Feodor de Zubovits of a land torpedo.

June 8. Upon the torpedo system of the Coast and Harbor Defense Company.

River and Harbor Improvements.—The Board during the year has submitted reports upon the following projects:

1882. October 2. For improvement of the bar opposite Fort Hale, New Haven Harbor, Connecticut.

1883. January 29. Preliminary report upon subject of improving Lynn Harbor, Massachusetts.

May 19. Upon proposed change in direction of dike in New Haven Harbor, Connecticut.

Studies not reported upon.—Considerable study has been given to the subject of the improvement of the Fox and Wisconsin rivers, but a visit to the localities by the Board will be necessary before a report can be submitted upon the whole question referred to it.

Much careful study has been given to the revision of present plans

for barbette batteries for heavy guns. The further investigation of this subject will engage the attention of the Board during the ensuing year.

In addition to their duties with the Board of Engineers, the individual members have been otherwise engaged during the year, as follows:

General Newton has continued the important works of improvement under his charge in New York Harbor and elsewhere; has served on special boards for the examination of officers for promotion in the Corps of Engineers; and on joint board of Army and Navy officers upon plans and location of a bridge across the Thames River at New London, Conn.

General Abbot has remained in command of the Engineer Battalion and School of Application at Willets Point, and in charge of torpedo experiments and construction of the works of defense at eastern entrance to New York Harbor. He has also served on special boards for the examination of candidates for promotion in the Corps of Engineers, and on boards of officers to examine and report which of the navy-yards or arsenals owned by the Government has the best location and is best adapted for the establishment of a Government foundry, or what other method, if any, should be adopted for manufacture of heavy ordnance, &c.

General Comstock continued in charge of the Survey of Northern and Northwestern Lakes to its completion in January, 1883; has served during the year as member of the Mississippi River Commission, and as its president since December 1, 1882. He has also served on special boards for the examination of officers for promotion in the Corps of Engineers; and on Board to examine in detail the mouth of the Columbia River, Oregon, and report plan with estimate for its permanent improvement.

BOARD OF ENGINEERS FOR THE PACIFIC COAST.

The Board has consisted of the following officers of the Corps of Engineers: Col. C. S. Stewart, Lieut. Col. Geo. H. Mendell, Capt. A. H. Payson, recorder. Captain Payson was relieved from duty with the Board March 19, 1883.

The Board during the year has considered and acted upon the subject of the storage of torpedoes intended for use in San Francisco Harbor.

BATTALION OF ENGINEERS AND ENGINEER SCHOOL OF APPLICATION.

The strength of the Battalion of Engineers on June 30, 1883, was 16 commissioned officers and 181 enlisted men. The legal organization authorizes 752 enlisted men, but only 200 are now allowed to be recruited. The Battalion is commanded by Lieut. Col. Henry L. Abbot, and is stationed as follows: The field, staff, and band, and Companies A, B, C, and D (the latter existing only on paper), at Willets Point, New York Harbor; Company E at West Point, N. Y.

During the past year recruiting has been restricted to men applying at these two posts and to occasional assignments of selected men from the General Depot at David's Island. This system during the past year has failed to provide the needful number of recruits, and it has been found impossible to keep up the companies even to the reduced standard now authorized.

The changes in personnel during the past year have consisted of 24 discharges by expiration of service; 2 for disability; 6 by order; 2 transfers to other arms of service; 20 desertions; 11 re-enlistments; 17 enlistments; 13 recruits from depot; and 1 deserter apprehended.

The Engineer troops are under the same strict military discipline and organization as the other three arms of service, and are equally to be depended upon in case of any emergency. During the past year they have guarded and cared for about three million dollars' worth of public property at Willets Point, have performed much skilled labor, such as remodeling the ponton trains of the Army to conform to the required pattern, printing and photolithographing confidential engineer documents, executing the practical trials to develop and perfect our system of torpedo defense, and have instructed the cadets at West Point in sapping, mining, pontoniering, military signaling, &c.

In war their special duties are of the most important character, including the defense of our coasts with submarine mines or torpedoes, military reconnaissances, duplication of maps by photography and photolithography, the attack and defense of military positions by saps, mines, &c., pontoniering, and other military bridge constructions.

To keep the troops always ready to perform these duties, which require not only high intelligence but also long and continued training, and to afford the recent graduates of the Military Academy assigned to the Corps of Engineers an opportunity to acquire practical experience, only to be had by serving with troops and by applying their theoretical knowledge of engineering to actual practice, the post at Willets Point has been gradually transformed into a useful school of application. It is primarily designed as a military school, but the officers are also exercised in several branches of civil engineering as well. The full course for our officers covers about two and a half years, and a few officers of other arms have been allowed to take the special course in torpedoes. During the past season three artillery officers have done so with credit, qualifying themselves for detail in this branch of military engineering. So soon as necessary quarters are provided, it is believed that such permits can advantageously be extended to increased numbers of officers of other arms.

I cannot too strongly urge the necessity of an increase in the number of enlisted men of the Battalion to the full number (752) now authorized by law. This would not only afford some reasonable ground for expecting that our harbors could be obstructed with torpedoes before the arrival of a hostile fleet on the outbreak of the next war with a maritime power, but would also permit details of enlisted men to be sent to the several military departments to aid in the military surveys now in progress for the use of the troops operating against Indians. Many applications have been made for such men and necessarily refused because the wretchedly inadequate force now recruited permits of no reduction by such detachments. No increase in commissioned officers is recommended, and no increase of enlisted men beyond the number now authorized by law. An organization less than that is insufficient for the evident military necessities of the country.

(See Appendix No. 2.)

ENGINEER POST AND DEPOT OF WILLETS POINT, NEW YORK HARBOR.

At Willets Point is situated the Engineer School of Application where officers newly assigned to the Corps complete the purely theoretical course of instruction received at West Point, and where the enlisted men are trained in their duties as sappers, miners, and pontoniers, in military map making and printing, and as the torpedo corps, upon which the defense of the coast by submarine mines will devolve when the next

war occurs with a maritime power. The establishment, begun on a small scale immediately after the late civil war, has steadily advanced until it now supplies a need long felt by the Engineer service. A few officers of other arms of service have recently been allowed to take special courses of instruction.

The depot contains such portions of the submarine mining material purchased for the defense of the coast as requires the watchful care and attention of experts to protect against deterioration; the bridge equipage of the Army; the engineer trains for field service; the astronomical, geodetic, and surveying instruments in store for use upon the special civil and military works of the Corps. The whole of this property is guarded and cared for by the soldiers of the Engineer Battalion.

The usual appropriation of $1,000 for the instruction of these troops in their field duties, and of $4,000 for the current expenses of the depot, is requested; also the sum of $1,000 by which the appropriation asked for last year was reduced, thus causing an accumulation of instruments in depot needing repairs before they can be reissued, and compelling the purchase of new instruments to take their places from the appropriations for special works; also the sum of $10,000 for the erection of a new double house greatly needed as officers' quarters, and $1,200 for constructing a small building as quarters for a sergeant, whose duties require him to live near the torpedo property under his immediate charge. These sums will essentially complete the public buildings now needed at this important post.

Statement of funds.

Amount expended and pledged for fiscal year 1882–'83	$10,000 00
Amount available for fiscal year 1883–'84	7,000 00
Amount desired for fiscal year 1884–'85, as above	17,200 00

(See Appendix No. 3.)

RIVER AND HARBOR IMPROVEMENTS.

The funds with which the works for the improvement of rivers and harbors were prosecuted during the past fiscal year were derived from the appropriations of the act of August 2, 1882, together with such balances as were on hand from previous appropriations.

A brief statement is given below, setting forth the condition of each improvement, the extent of the work performed during the year, the amount of money expended, and an estimate of the probable cost of completion, together with an estimate of the amount that can be profitably expended during the year ending June 30, 1885.

The reports of the officers in charge of the various improvements will be found in the Appendix, and to these reports special reference should be made whenever detailed information is desired concerning the progress and condition of each work.

The examinations and surveys at localities required and provided for in the river and harbor act of August 2, 1882, were distributed and assigned to the officers in charge of the several river and harbor districts.

The act provides that no survey shall be made of any of the harbors or rivers therein enumerated until the Chief of Engineers shall have directed a preliminary examination of the same by the local engineer in charge of the district, and then only when said local engineer shall have made such examination, and shall have reported to the Chief of

Engineers that, in his judgment, said harbor or river is worthy of improvement and the work is a public necessity.

These required preliminary examinations were completed during the fiscal year. Their results, together with the action of the Chief of Engineers in each case, will be made the subject of a separate communication.

An allotment has been made of the funds required for such surveys as have been found to come within the provision of the above act, and as far as the amount appropriated applicable thereto would admit.

These surveys are in progress, and the reports thereon will be submitted from time to time during the ensuing session of Congress as far as received.

ATLANTIC COAST.

IMPROVEMENT OF RIVERS AND HARBORS IN THE STATES OF MAINE AND NEW HAMPSHIRE.

Officers in charge, Col. George Thom, Corps of Engineers, until January 16, 1883; since which time, Col. Charles E. Blunt, Corps of Engineers.

1. *Lubec Channel, Maine.*—The following appropriations have been made for this thoroughfare:

By act of March 3, 1879	$44,000
By act of June 14, 1880	20,000
By act of March 3, 1881	45,000
By act of August 2, 1882	20,000
Total	129,000

The project for its improvement was based upon a survey made in 1878, the object being to make it navigable in all stages of the tide by giving it a width of not less than 200 feet and a depth of 12 feet at mean low water, or about 9 feet at low-water of spring-tides. This required the deepening of several bars situated between the head of "The Narrows" and "Western Bar Beacon" (a distance of about 2½ miles), the shoalest of which had a depth of not more than 5 feet at mean low water.

The execution of this project has been completed during the past fiscal year.

The balance available July 1, 1883, will be expended before June 30, 1884, in widening the channel at the southern bend, &c.

The increased size in tonnage and draught of water of vessels using it requires, in the opinion of the officer in charge, an increase of width and depth of this channel to 275 and 15 feet respectively, which he estimates would cost $113,000, one-third of which, or say $40,000, could be profitably expended during the next fiscal year.

July 1, 1882, amount available		$67,843 15
Amount appropriated by act passed August 2, 1882		20,000 00
		87,843 15
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$66,325 99	
July 1, 1883, outstanding liabilities	6,338 27	
		72,664 26
July 1, 1883, amount available		15,178 89
Amount (estimated) required for completion of existing project		113,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		40,000 00

(See Appendix A 1.)

2. *Moose-a-bec Bar, at Jonesport, Maine.*—The project for the improvement of the channel at this place was adopted in 1881, the object being to afford a safe and direct channel of not less than 200 feet in width and 14 feet in depth at mean low water, or 11¾ feet at low-water of spring-tides, the mean fall of tides being 11½ feet. The main channel is very narrow and tortuous, and so much obstructed by sunken ledges as to make navigation very unsafe.

The estimated cost of this improvement, as amended, is $40,000. Two appropriations have been made, viz:

By act of March 3, 1881	$10,000
By act of August 2, 1882	10,000
Total	20,000

Under the first appropriation the new channel was opened to a width of 85 feet. Under the second it was expected to add 65 feet to this width. A contract has been made, which it is hoped will be executed this season.

An additional amount of $20,000 will be required for completing this improvement, viz, $14,000 for dredging, and $6,000 for the removal of the sunken ledge.

July 1, 1882, amount available		$514 28
Amount appropriated by act passed August 2, 1882		10,000 00
		10,514 28
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$132 03	
July 1, 1883, outstanding liabilities	58 00	
		190 03
July 1, 1883, amount available		10,324 25
Amount (estimated) required for completion of existing project		20,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		20,000 00

(See Appendix A 2.)

3. *Belfast Harbor, Maine.*—The project for the improvement of this harbor was adopted in 1876, the object being to give a depth in front of the wharves sufficient to enable steamers and other vessels to arrive and depart in all stages of the tide. In the upper part of the harbor, in front of Lane's wharf, there was not more than 4 feet of water at mean low water, when surveyed in 1875, and this depth increased downwards to about midway between Sanford's Boston steamer wharf, and McGilvery's ship-yard, where there was 12 feet of water at mean low water.

Under the several appropriations, aggregating $22,000, made in the years 1876, 1878, and 1879, this harbor has been excavated to a depth of 10 to 12 feet at mean low water from the wharf-lines out to deep water, in completion of the project adopted, leaving unexpended the appropriation of $3,000 made therefor by the river and harbor act of June 14, 1880.

July 1, 1882, amount available	$3,000 00
July 1, 1883, amount available	3,000 00

(See Appendix A 3.)

4. *Rockland Harbor, Maine.*—The project for the improvement of this harbor was adopted in January 1881, the object being to afford a safe and convenient harbor of refuge at this place by means of two rubble-stone breakwaters, one to be built out from Jameson Point in a direction of about south 16½ degrees east for a distance of 1,900 feet from

high-water mark, and the other to commence at South Ledge and extend in a direction about north 9 degrees east for a distance of 2,640 feet.

The estimated cost of these breakwaters is as follows, viz:

Jameson Point Breakwater	$135,000
South Ledge Breakwater	415,000

Two appropriations have been made, viz: June 14, 1880, $20,000, and August 2, 1882, $40,000.

During the fiscal year ending June 30, 1883, the Jameson Point Breakwater has been extended 326 feet, to a point 1,109 feet from high-water mark, by the addition of 30,232 tons of rubble-stone furnished and placed by contract.

The officer in charge asks that $75,000 be appropriated for the fiscal year ending June 30, 1885, for completing the breakwater at Jameson Point.

July 1, 1882, amount available	$127	20
Amount appropriated by act passed August 2, 1882	40,000	00
	40,127	20
July 1, 1883, amount expended during fiscal year exclusive of outstanding liabilities July 1, 1882	36,665	63
July 1, 1883, amount available	3,461	57
Amount (estimated) required for completion of existing project	490,000	00
Amount that can be profitably expended in fiscal year ending June 30, 1885	75,000	00

(See Appendix A 4.)

5. *Richmond Harbor, Kennebec River, Maine.*—The Kennebec River channel near this place, at the upper end of Swan Island, and at Hatch's Rocks, 2 miles below, was narrow, and not more than 8¼ feet deep at mean low water, while at the foot of Swan Island it was not over 30 feet wide, with a mean low-water depth of 11 feet. The adopted project for improvement was for channels of navigable width and mean low-water depth of at least 11 feet at the foot of Swan Island and at least 10 feet at the head of the island and at Hatch's Rocks. This project has been completed during the past fiscal year.

July 1, 1882, amount available	$6,531	03
Amount appropriated by act passed August 2, 1882	10,000	00
	16 531	03
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	16,531	03

(See Appendix A 5.)

6. *Cathance River, Maine.*—The project for the improvement of this river was based upon the survey made in 1879, the object being to afford a channel of navigable width and of not less than 10 feet depth at mean low water (or 15½ feet at mean high water), from the outlet of the river into Merrymeeting Bay to the channel of Kennebec River near "The Chops," a distance of about 2⅛ miles. The natural channel was crooked, and had but 6 feet of water at mean low water in its shoalest part. Three appropriations have been made, viz:

By act of June 14, 1880	$10,000
By act of March 3, 1881	6,000
By act of August 2, 1882	5,000
Total	21,000

Work under the first two appropriations was completed on the 22d of October, 1881.

The last appropriation has been applied to the improvement of the channel at "The Outer Bar," near "The Chops."

No additional work is proposed for this river.

July 1, 1882, amount available		$58 67
Amount appropriated by act passed August 2, 1882		5,000 00
		5,058 67
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$2,723 85	
July 1, 1883, outstanding liabilities	689 52	
		3,413 37
July 1, 1883, amount available		1,645 30

(See Appendix A 6.)

7. "*Gut,*" *opposite Bath, Maine.*—The project for the improvement of the channel at this place was adopted in 1870, and modified in 1878, the object being to afford a navigable channel not less than 90 feet in width at and near "Upper Hell Gate" in Back River, and of not less than 11 feet in depth at mean low water above the "Gate" and 12 feet in depth below it. The channel was originally very crooked and narrow, and much obstructed by dangerous sunken ledges, the shoalest of which had not more than 3 feet of water on it at mean low water.

Appropriations for this work amounting to $44,500 have been made, commencing in 1870 and ending in 1881. These funds have been expended and the projected improvements completed. The channel above the "Gate" has been opened to the projected width (110 feet) and depth of 12 feet at mean low water for a part of its extent only.

The work done during the fiscal year has been the removal of a sunken ledge. Operations ceased on the 13th day of September, 1882.

July 1, 1882, amount available	$2,981 75
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	2,981 75

(See Appendix A 7.)

8. *Royal River, Maine.*—The channel of this river opposite Wolfe's Point, just above its mouth, was obstructed by a land-slide in March, 1882. It was proposed to dredge a new channel, and to divert the current into it and away from the bank by a wing-dam at an estimated cost of $10,000, which sum was appropriated August 2, 1882.

Contract was made for the wing-dam March 27, 1883, and under it 2,277 tons of rubble-stone had been delivered and placed in position up to June 30. This wing-dam will be completed this fall.

The dredging of the new channel, it is expected, will be completed before winter. Nothing more is needed for this river.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$1,594 23	
July 1, 1883, outstanding liabilities	324 80	
		1,919 03
July 1, 1883, amount available		8,080 97

(See Appendix A 8.)

9. *Portland Harbor, Maine.*—The project for the improvement of this harbor by building a breakwater on Stanford's Ledge was adopted in 1833–'36 and was modified in 1866, 1872, and 1881, as to the plan for the completion of the breakwater, and the improvement of the harbor by dredging. The amount expended thereon up to the close of the fiscal

year ending June 30, 1882, was about $309,000, by which the following work has been done, viz:

1. The breakwater extended and completed for a total length of 2,005 feet, including the granite pier, 25 feet in diameter, at its outer extremity.

2. A channel dredged through the Middle Ground Bar to a width of 500 feet, and to a depth of 20 to 22 feet at mean low water, on the shoalest part of which there was originally but 15 feet at mean low water.

3. The area in front of the Grand Trunk Railway wharves dredged to a depth of 20 feet at mean low water, and all that in front of the Harbor Commissioners' Line, from Atlantic Wharf up to Merrill's Wharf to a depth of 16 feet, where, before, on its shoalest part, there was but 4 feet of water at mean low water.

4. The channel in Back Bay, from Tukey's Bridge up to the Stone-shed Wharves, dredged to a width of not less than 100 feet and for a depth of 8 feet, where before, on its shoalest part, there was but 2 feet of water at mean low water.

5. Sunken rocks and wreck removed from the harbor.

6. Dredging at the "Middle Ground" in the lower part of the harbor, giving an additional width of about 400 feet to the main channel, making its aggregate width about 900 feet for a depth of about 21 feet at mean low water, on the shoalest part of which there was originally but 10 feet at mean low water.

During the fiscal year ending June 30, 1883, the additional sum of $25,487.08 has been expended, whereby 170,347 cubic yards of dredging has been done at the "Middle Ground," giving an additional width of about 350 feet to the main channel, making its aggregate width about 1,250 feet for a depth of about 21 feet at mean low water.

The officer in charge asks that $75,000 be appropriated for the fiscal year ending June 30, 1885, for completing the dredging at the "Middle Ground."

July 1, 1882, amount available		$1,181 46
Amount appropriated by act passed August 2, 1882		35,000 00
		36,181 46
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$20,336 28	
July 1, 1883, outstanding liabilities	5,150 80	
		25,487 08
July 1, 1883, amount available		10,694 38
Amount (estimated) required for completion of existing project		75,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		75,000 00

(See Appendix A 9.)

10. *Kennebunk River, Maine.*—The project originally adopted for the improvement of this river consisted in the erection, in 1829–'52, of two granite piers at its mouth, to afford a permanent entrance to the river, and of a wharf a short distance above, for the security of vessels when detained by tides and storms. With the appropriations made in 1870 and 1871, aggregating $10,000, these piers were extended and repaired, and the wharf above was also repaired. This project was modified in 1876, the object being to afford a channel of navigable width from the mouth of the river up to Kennebunkport, a distance of about 1 mile, and of not less than 4 feet in depth at mean low water, or 13 feet at mean high water.

The amount expended from 1870 to June 30, 1882, is $19,971.25, and

has resulted, in addition to the extension and repairs of the piers and wharf, in the completed improvement of the channel as projected.

No repairs have been found necessary during the fiscal year ending June 30, 1883. Should any be required during the coming year, the balance available can be applied thereto.

July 1, 1882, amount available	$1,028 85
July 1, 1883, amount available	1,028 85

(See Appendix A 10.)

11. *Winnepissiogee Lake, New Hampshire.*—The project for the improvement of this lake was adopted in 1879, the object being to afford at its outlet into Long Bay a channel 50 feet in width and not less than 5 feet in depth in the lowest known stage of the water, the estimated cost of which was $7,500.

The appropriations for this purpose have been:

By act of June 14, 1880	$5,000
By act of March 3, 1881	2,500
Total	7,500

which amount has been expended, and the projected work completed, that under the last contract (made June 17, 1881,) having been fully executed on the 23d of August, 1882.

July 1, 1882, amount available	$3,266 05
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,266 05

(See Appendix A 11.)

12. *Lamprey River, below New Market, New Hampshire.*—The project for the improvement of this river was adopted in 1874, the object being to afford a channel of navigable width and not less than 11 feet in depth at mean high water from its mouth to the head of tide-water at New Market, a distance of about 2½ miles. The natural channel was in places narrow and crooked, and much obstructed by sunken rocks and shoals, with not more than 9 feet of water upon them at mean high water.

Two appropriations have been made for this work, viz:

By act of March 3, 1881	$10,000
By act of August 2, 1882	10,000
Total	20,000

The balance available at the beginning of the year was expended in the improvement of the channel, completing it between the Lower Narrows and the lower wharf in New Market.

Under the appropriation of August 2, 1882, contract was made for dredging in front of the New Market wharves. This work was completed May 14, 1883. Sunken rocks in the channel were also removed.

The officer in charge asks that $4,000 be appropriated for completing the projected improvement of this river.

July 1, 1882, amount available		$5,674 75
Amount appropriated by act passed August 2, 1882		10,000 00
		15,674 75
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		15,366 33
July 1, 1883, amount available		308 42
Amount (estimated) required for completion of existing project	4,000 00	
Amount that can be profitably expended in fiscal year ending June 30, 1885	4,000 00	

(See Appendix A 12.)

13. *Cocheco River, New Hampshire.*—Appropriations for this work, amounting to $85,000, were made from 1871 to 1878, inclusive, and were expended in straightening, widening, and deepening the channel at various points between its outlet in Great Bay and Dover, N. H., the head of navigation.

No further appropriations were made till August 2, 1882, when $28,000 was granted for making a "cut-off" at a very abrupt and inconvenient bend of the river, and opening straight channels adjoining thereto, &c.

After considerable delay, caused by the necessity of procuring a right of way through the point at the bend, contract was made for the "cut-off" and channels on the 4th of May, 1883, under which operations are progressing satisfactorily. It is expected that this contract will be completed by the close of navigation in 1883.

For the removal of heavy bowlders at various points of the channel additional funds will probably be needed, and the officer in charge asks for this purpose a further appropriation of $4,000.

Amount appropriated by act passed August 2, 1882		$28,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$8,757 44	
July 1, 1883, outstanding liabilities	1,999 40	
		10,756 84
July 1, 1883, amount available		17,243 16
Amount (estimated) required for completion of existing project		4,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		4,000 00

(See Appendix A 13.)

14. *Portsmouth Harbor, New Hampshire.*—The project for the improvement of this harbor was adopted in 1879, the objects being:

1. To close, by means of a rubble-stone breakwater, the channel between Great Island and Goat Island, so as to prevent the strong current of flood-tide from passing through that channel, as by it vessels in going up the harbor were said to have been thrown upon Goat Island Ledge, which projects into the channel, here quite narrow.

2. The removal of Gangway Rock (which lies in the channel between South Beacon Shoal and the navy-yard) to a depth of 20 feet at mean low water, or 28½ feet at mean high water, the shoalest part of which has but 12 feet of water on it at mean low water and 9.7 feet at extreme low water of spring tides.

3. The removal, in part, to a depth of 10 feet at mean low water, of the ledge at the southwest point of Badger's Island, upon which vessels are liable to be, and have been, thrown in coming down the harbor on the ebb-tide.

The estimated cost of this improvement is $155,000, for which the following appropriations have been made, viz:

By the river and harbor act of March 3, 1879	$10,000
By the river and harbor act of June 14, 1880	25,000
By the river and harbor act of March 3, 1881	20,000
By the river and harbor act of August 2, 1882	17,000
Total	72,000

During the year ending June 30, 1883, the work done has been the removal of 440 cubic yards of Gangway Rock, and the removal of 250 cubic yards of the ledge at the southwest point of Badger's Island.

Operations now in progress will probably exhaust the available balance by the 1st of September, 1884.

The total amount expended up to June 30, 1883, in completing the Goat Island Breakwater, and removing 800 cubic yards of Gangway Rock, and 300 cubic yards of Badger's Island Ledge, was $43,798.90.

The officer in charge asks that $50,000 be appropriated for the fiscal year ending June 30, 1885, for continuing the removal of Gangway Rock.

July 1, 1882, amount available		$30,419 14
Amount appropriated by act passed August 2, 1882		17,000 00
		47,419 14
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$17,988 04	
July 1, 1883, outstanding liabilities	1,230 00	
		19,218 04
July 1, 1883, amount available		28,201 10
Amount (estimated) required for completion of existing project		83,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		50,000 00

(See Appendix A 14.)

HARBORS AND RIVERS IN MASSACHUSETTS.

Officer in charge, Maj. C. W. Raymond, Corps of Engineers. (These works were in charge of Col. George Thom, Corps of Engineers, to January 18, 1883.)

1. *Newburyport Harbor, Massachusetts.*—The project for the improvement of this harbor was adopted in 1880, and modified in 1883; the object being to secure a channel of about 1,000 feet in width at its entrance, with a depth of not less than 17 feet at mean low water, or 24½ feet at mean high water; this to be accomplished by constructing converging rubble-stone jetties, to be built out from the shores north and south of the entrance, thereby securing safe ingress and egress to vessels drawing 13 feet of water at lowest stage of tide.

The amount expended to June 30, 1882, was $41,975.41, and resulted in the construction, in part, of the north jetty for a length of about 1,200 feet.

The amount expended during the fiscal year ending June 30, 1883, is $41,544.09, and has resulted in extending the north jetty 340 feet, built up to full height and cross-section, completing the 1,200 feet partly built in 1882, making in all 1,540 feet of finished work, also building a submerged core reaching to the plane of low water 500 feet in advance of the finished work. Across "the basin" at Plum Island 817 linear feet of dike have been partly completed, and the south jetty constructed for a length of 507½ feet of sheet-piling and 357 feet of stone-work. To facilitate the study of sand movement, and for comparison with the survey of July and August, 1880, a detailed hydrographic survey of the bar and entrance to Merrimac River is in hand.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $150,000, which, if appropriated, it is proposed to expend in the simultaneous extension of the north and south jetties.

July 1, 1882, amount available		$45,438 77
Amount appropriated by act passed August 2, 1882		40,000 00
		85,438 77
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$38,861 40	
July 1, 1883, outstanding liabilities	2,682 69	
		41,544 09
July 1, 1883, amount available		43,894 68
Amount (estimated) required for completion of existing project		235,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		150,000 00

(See Appendix B 1.)

2. *Merrimac River, Massachusetts.*—The present project for the improvement of this river was adopted in 1870, and modified in 1874; the object being to afford a channel of navigable width, with a depth of not less than 9 feet at mean low water (or about 16½ feet at mean high water) from Plum Island Light, near its mouth, up to Deer Island Bridge; thence to Haverhill Bridge, a depth of 12 feet at ordinary high water, the rise and fall of the tide varying from 7½ feet to 4 feet; thence to the foot of Mitchell's Falls, a depth of 10 feet at ordinary high water; and thence through Mitchell's Falls, a depth of 4½ feet at ordinary stage of the river with the mill water at Lawrence running, to the head of the Upper Falls, being a total distance of 21½ miles of improved channel.

The natural channel of the river was very narrow, and crooked in several places, and much obstructed by sunken ledges, bowlders, and shoals, especially at the falls, portions of which were covered with bowlders and ledges more or less bare, while in Newburyport Harbor the channel was obstructed by numerous sunken ledges, crib-work piers, and wrecks.

The amount expended to June 30, 1882, was $154,646.21, and resulted in opening the channel above Haverhill and through the falls; in dredging at Haverhill between the bridges, at Silsby's Island Shoals, Currier Shoal, at Rock's Bridge, and the head of Silsby's Island, the removal of Gangway Rock in Newburyport Harbor, South Gangway Rock, North Rock Spur, and the removal in part of South Badger Ledge; also a survey of the river from Lawrence, Mass., to Manchester, N. H. (a distance of 50 miles), with a view to making it navigable.

The amount expended during the fiscal year ending June 30, 1883, is $8,023.88 and has resulted in the breaking up and removal of South Badger Ledge and the removal in part of North Rock. A survey and map of the channel, with a view to conform to the new conditions consequent upon the relocating and rebuilding of the drawbridge at that point, has been made also.

To complete the improvement of the river so that the same depth of water which has been obtained through Mitchell's Falls can be carried to Lawrence, additional work will be required, the cost of which is estimated at $26,000, which amount, if appropriated, can be profitably expended during the fiscal year ending June 30, 1885.

July 1, 1882, amount available		$3,353 79
Amount appropriated by act passed August 2, 1882		9,000 00
		12,353 79
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$7,673 88	
July 1, 1883, outstanding liabilities	350 00	
		8,023 88
July 1, 1883, amount available		4,329 91
Amount (estimated) required for completion of existing project		26,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		26,000 00

(See Appendix B 2.)

3. *Scituate Harbor, Massachusetts.* (In charge of Maj. F. Harwood, Corps of Engineers, from January 18 to March 26, 1883, and of Lieut. Col. G. H. Elliot, Corps of Engineers, to April 4, 1883.)—The project for the improvement of this harbor was adopted in 1880, the object being to make it a harbor of refuge for vessels caught in easterly storms off this coast when unable to find shelter elsewhere. This project consists of—

1. Building two breakwaters; one from Cedar Point, on the north side of the harbor, and the other from the First Cliff, on the south side, for a length of 800 and 730 feet, respectively.

2. Dredging the harbor inside of the breakwaters, as well as the channel leading up to it, to depths varying from 10 to 15 feet at mean low water, the mean rise and fall of the tide being about 9 feet.

The estimated cost of this improvement in 1882 was $290,000.

The amount expended to June 30, 1882, was $17,076.40, and resulted in building up the north breakwater for a length of 470 feet, and height of about 3 feet above mean high water.

The amount expended during the fiscal year ending June 30, 1883, is $10,079.91, and has resulted in extension of the north breakwater and connecting it with the shore for a total length of 720 feet, and height of about 4 feet above mean high water; also the construction of 450 linear feet of brush and stone bulkhead, and placing a stone apron in front for a length of 385 feet and a width of 10 feet, for the protection of the beach between Cedar Point and the mainland.

The amount which can be profitably expended during the fiscal year ending June 30, 1885, is $75,000, which, if appropriated, it is proposed to expend in building the south breakwater and dredging the channel.

July, 1, 1882, amount available		$203 54
Amount appropriated by act passed August 2, 1882		10,000 00
	10,203 54	
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		10,079 91
July 1, 1883, amount available		123 63
Amount (estimated) required for completion of existing project		262,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		75,000 00

(See Appendix B 3.)

4. *Boston Harbor, Massachusetts.*—The improvements in this harbor undertaken by the General Government since 1866 were projected from time to time as the interests and necessities of the harbor demanded, being in general conformity with the recommendations of the United States Commissioners whose labors terminated with that year. The objects of these improvements have been:

1. The preservation of the islands and headlands by permanent sea-walls or aprons and jetties of rubble-stone, for the purpose of protecting the channels against encroachment, controlling the resultant tidal scour, and securing shelter to vessels in roadsteads.

2. The widening, straightening, and deepening of the main ship-channel by dredging, and the removal of dangerous sunken rocks, thereby securing a channel of not less than 600 feet in width, with a depth of 23 feet at mean low water.

3. The widening, deepening and straightening of the channel in Hingham Harbor and the removal of sunken ledges for a width of 100 feet and depth of 8 feet at mean low water.

4. The opening of a channel at the mouth of the Mystic River for a width of 400 feet and depth of 23 feet at mean low water.

5. The widening, deepening, and straightening of a channel from the mouth of Charles River up to Watertown.

6. The widening and deepening of the channel leading up from the harbor to Nantasket Beach wharves for a minimum width of 100 feet and depth of 9½ feet at mean low water.

7. The removal of sunken rocks and ledges, endangering navigation in the main channel, its borders and approaches.

Before the improvement, the main channel from its entrance to the wharves was but 100 feet wide in its narrowest part, with a depth in its shoalest part of 18 feet at mean low-water, and obstructed by many sunken ledges.

The channel leading up to Hingham Harbor was but 30 feet wide in its narrowest part, with a minimum depth of 4 feet at mean low water.

The channel at the mouth of Mystic River was but 16 feet deep at mean low water, with a minimum width of 150 feel.

The channel of Charles River was but 3½ feet deep, with a minimum width of 50 feet.

The channel leading up to Nantasket Beach was but 6½ feet deep in its shoalest part, with a minimum width of 50 feet.

The islands and headlands were being rapidly worn away by tide and storm action, not only seriously injuring the channel, but endangering navigation by the obliteration of guide-marks for sailing directions.

Since 1866 there have been appropriated by Congress, in furtherance of these improvements, $1,602,500; of which amount there had been expended at the close of the fiscal year ending June 30, 1882, $1,437,337.37. By this expenditure permanent sea-walls have been constructed at the various islands and headlands in the harbor, protecting them from encroachments and furnishing shelter in the roadsteads. From time to time these works have been repaired.

Numerous rocks and sunken ledges have been removed from the various channels, their borders and approaches.

The main channel has been dredged to a depth of 23 feet at mean low water, with a width of 600 feet from its outer entrance to the wharves in Boston.

The Hingham Harbor improvement has been completed, with a channel 100 feet wide and 8 feet deep at mean low water.

The channel at the mouth of Mystic River has been deepened to 23 feet at mean low water, with a minimum width of 375 feet.

The Charles River has been deepened from its mouth up to Western Avenue Bridge to 7 feet in its shoalest part at mean low water, with a minimum width of 200 feet.

Surveys have also been made of Boston Harbor (proper), Hingham Harbor, Charles River, Anchorage Shoals, shoals at the mouth of Mystic River, and channel leading up to Nantasket Beach.

By far the greater part of the expenditure in Boston Harbor has been for its *preservation*, rather than for the increase of its navigable capacity.

During the fiscal year ending June 30, 1883, $46,318.50 have been expended, which has resulted in making repairs to sea-walls at the north head of Long Island, Gallop's and Lovell's Islands, spreading rubble-stone in apron in front of walls and at junctions with shore banks, and in extending sea-walls at Gallop's and Lovell's Islands.

The Anchorage Shoal and the shoal at the mouth of Mystic River have been dredged. An examination of parts of the channel in the Narrows has been made.

A close resurvey (for dredging *in situ*) of Charles River, from Brighton Street Bridge up to Watertown Bridge, and survey of the channel between Nick's Mate and the north head of Long Island have been made.

Works of preservation will be continued during the present working

season, and a channel will be dredged between Nick's Mate and the north head of Long Island.

The spur of Castle Island Shoal will be removed, and the improvement of Charles River will be continued.

The amount estimated as required for projected works is as follows:

Widening the main ship-channel at the Upper and Lower Middle	$128,000
Survey of Brewster Bar, and resurvey of portions of the Narrows	1,000
Charles River, continuing the improvement	116,000
Total	245,000

AMOUNT ESTIMATED TO BE EXPENDED IN THE FISCAL YEAR ENDING JUNE 30, 1885.

Boston Harbor (proper)		$130,000
Charles River		50,000
Total		180,000
July 1, 1882, amount available		$68,662 63
Amount appropriated by act passed August 2, 1882		95,500 00
		165,162 63
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	46,318 50	
July 1, 1883, outstanding liabilities	8,042 12	
		54,360 62
July 1, 1883, amount available		110,802 01
Amount (estimated) required for completion of existing project		245,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		180,000 00

(See Appendix B 4.)

5. *Plymouth Harbor, Massachusetts.* (In charge of Maj. F. Harwood, Corps of Engineers, from January 18 to March 26, 1883, and of Lieut. Col. G. H. Elliot, Corps of Engineers, to April 4, 1883.)—The project for the improvement of this harbor was adopted in 1866, and modified in 1875, and 1882 the object being—

1. To protect and preserve Long Beach, on which the harbor depends wholly for its shelter from easterly storms; and

2. To open a channel of navigable width, with not less than 16 feet depth at mean low water.

The natural channel was very narrow and crooked, and not more than half a foot in depth at mean low water in its shoalest part.

Since 1866 there has been allotted and appropriated for the improvement of this harbor $98,800; of this amount, $84,710.33 had been expended at the close of the fiscal year ending June 30, 1882, and the projects of 1866 and 1875 were then reported as completed.

In furtherance of the modification of 1882, during the fiscal year ending June 30, 1883, $12,968.53 have been expended, resulting in the prolongation of the bulkhead along the western shore of the beach, an additional 830 feet, backing the old portion of this bulkhead with cedar trees and small stone, so as to render it sand-tight for a length of 640 feet, building a catch-sand fence of cedar trees and stone parallel to and 15 feet east of the old triangular bulkhead for a length of 730 feet, and stopping a leak north of the old crib-work by backing 60 feet of the stone bulkhead with trees and small stone.

For the further necessary protection and preservation of this beach it is estimated that $19,000 will be required, all of which could be profitably expended during the fiscal year ending June 30, 1885.

July 1, 1882, amount available	$89 67
Amount appropriated by act passed August 2, 1882	14,000 00
	14,089 67
July 1, 1883, amount expended during the fiscal year, exclusive of outstanding liabilities July 1, 1882	12,968 53
July 1, 1883, amount available	1,121 14
Amount (estimated) required for completion of existing project	19,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	19,000 00

(See Appendix B 5.)

6. *Provincetown Harbor, Massachussetts.* (In charge of Maj. F. Harwood, Corps of Engineers, from January 18 to March 26, 1883, and of Lieut. Col. G. H. Elliot, Corps of Engineers, to April 4, 1883.)—This is one of the most important harbors on the Atlantic coast, easy of access and completely protected, affording safe anchorage for all classes of vessels navigating the ocean. The entire commerce of New England is directly benefited by its maintenance, which depends wholly upon the preservation of the beaches inclosing it.

The present project was adopted in 1866, and modified at different times up to 1873. The objects were the protection and preservation of Long Point, Beach Point, and the beach at Cove Section, and the closing of the side channels at the head of Lancy's Harbor, and at East Harbor Creek (at the Wading Place), near High Head.

The improvements in this harbor have been remarkably successful.

The amount which has been appropriated since 1866 is $111,568.44, of which $105,012.07 had been expended at the close of the fiscal year ending June 30, 1882, resulting in the completion of the project of improvement, as reported by the officer then in charge, with the exception of the stone bulkhead protection on Long Point.

During the fiscal year ending June 30, 1883, $2,995.74 have been expended, resulting in extending the bulkhead protection on Long Point for a length of 367 feet.

The amount estimated for further improvement, protection, and preservation of the beach, and for a resurvey of the harbor, is $5,860, all of which can be profitably expended during the fiscal year ending June 30, 1885.

July 1, 1882, amount available		$1,556 35
Amount appropriated by act passed August 2, 1882		5,000 00
		6,556 35
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities, July 1, 1882	$2,920 86	
July 1, 1883, outstanding liabilities	74 88	
		2,995 74
July 1, 1883, amount available		3,560 61
Amount (estimated) required for completion of existing project		6,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		6,000 00

(See Appendix B 6.)

7. *Lynn Harbor, Massachusetts.*—Lynn Harbor is distant about 10 miles in a northeastern direction from Boston, Mass. It is a sheet of water about 3 miles in extent from north to south, and has an average width east to west of about 1½ miles, being limited on the east by the peninsula of Nahant and Long Beach, and on the north and west by the city of Lynn and Chelsea Beach.

The greater part of this harbor is bare at low water, except in the narrow, crooked channels. It is open to southerly winds, and is with-

out any protection from them except that afforded on the southward by the peninsula of Nahant.

A survey of this harbor was made in 1881, and a project for its improvement submitted in the Annual Report of the Chief of Engineers of 1882. This project has been referred to the Board of Engineers for Fortifications and for River and Harbor Improvements, and the subject is still under consideration.

During the fiscal year ending June 30, 1883, an additional survey, required by the Board, was in part made, and is nearing completion.

Amount appropriated by act passed August 2, 1882	$60,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	2,138 07
July 1, 1883, amount available	57,861 93
Amount (estimated) required for completion of existing project	210,000 00

(See Appendix B 7.)

8. *Malden River, Massachusetts.*—The present project for the improvement of this river was adopted in 1882, its object being to straighten, widen, and deepen the channel by dredging, following the natural bed of the river, from its mouth up to the second drawbridge in Malden, so as to afford a safe passage for vessels drawing 10 feet of water when ascending the river on the high water of neap tides, at an estimated cost of $35,000.

The natural channel is crooked, barely affording passage for vessels drawing 7 feet of water.

In furtherance of this improvement, $10,000 have been appropriated by Congress.

During the fiscal year ending June 30, 1883, $1,310.63 have been expended, resulting in making a channel 1,200 feet in length, 30 feet wide, and 12 feet deep at mean high water.

To complete the improvement under the existing project, in view of the increase of prices, $37,000 are required, all of which can be profitably expended during the fiscal year ending June 30, 1885.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$1,202 33	
July 1, 1883, outstanding liabilities	108 30	
		1,310 63
July 1, 1883, amount available		8,689 37
Amount (estimated) required for completion of existing project		37,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		37,000 00

(See Appendix B 8.)

IMPROVEMENT OF HARBORS AND RIVERS ON THE SOUTHERN COAST OF MASSACHUSETTS, AND IN RHODE ISLAND AND CONNECTICUT.

Officer in charge, Lieut. Col. George H. Elliot, Corps of Engineers. (These works were in charge of Lieut. Col. G. K. Warren, Corps of Engineers, until his death, August 8, 1882, and, with the exception of Hyannis and Wareham, of Maj. J. W. Barlow, Corps of Engineers, from that date to November 1, 1882.)

1. *Hyannis Harbor, Massachusetts.* (In charge of Maj. F. Harwood until his death, March 26, 1883.)—This harbor is on the northern shore of Nantucket Sound, and is sheltered by a breakwater 1,170 feet long. It has a depth of from 9 to 20 feet at mean low water and an area of about 175 acres. The mean rise and fall of the tide is about 3.8 feet. It is

accessible to vessels drawing 16 feet at time of mean low water. The breakwater was built in 1828–1837, at a cost of $70,931.82. In 1853 the sum of $5,000 was spent in repairs. Although the breakwater has sustained injuries, it has always afforded effective shelter.

In 1870, repairs were again made on it, and between that time and June 30, 1880, $42,500 have been expended in building up the foundation of the work and in removing a wreck.

No money was appropriated or expended during the year ending June 30, 1881.

The river and harbor act of March 3, 1881, appropriated $5,000, which was expended during the fiscal year in building up the slopes of the foundations of the breakwater, in accordance with the approved project of 1874. This completed the repairs.

The utility of this harbor of refuge—it is the only harbor on the north shore of Nantucket and Vineyard Sounds between Cape Monomoy and Wood's Holl, a distance of 33 miles—would be greatly increased by deepening the water inside the breakwater, and by placing a light-house and fog-signal on the eastern end. A branch of the Old Colony Railroad from Boston terminates in this harbor, and considerable quantities of coal are landed here.

July 1, 1882, amount available		$278 63
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$18 00	
July 1, 1883, outstanding liabilities	75	
		18 75
July 1, 1883, amount available		259 88

(See Appendix C 1.)

2. *Nantucket Harbor, Massachusetts.*—Nantucket Harbor is on the north side of the island of Nantucket. The depth in the harbor exceeds 12 feet at mean low water, with a mean rise of tide of about 3 feet.

The shoal across the entrance has a ruling depth of about 6 feet at mean low water. This shoal is about 1¼ miles in width at the entrance, and extends for several miles along the shore each way. The channel across it, or line of best water, is very crooked, and frequently changes in direction, but its limiting depths seem to have been about the same as far back as we have any record of it.

In 1829 a project for dredging a channel through the shoal across the entrance was adopted, and in the years 1829, 1831, and 1832, $44,265 was expended in carrying it out. No permanent improvement resulted from this expenditure. The dredged channel was nearly obliterated by one storm.

The present approved and adopted project consists in extending rip-rap jetties from the shore across the bar to deep water outside. The jetty on the west side was to be built first, the other one to be built as developments show its necessity. The first appropriation was $50,000, made June 14, 1880.

During the year ending June 30, 1881, the jetty was built out from shore a distance of 850 feet.

There was appropriated for this work March 3, 1881, $25,000, and during the fiscal year ending June 30, 1882, the west jetty was extended to 1,650 feet from the shore.

By act of Congress of August 2, 1882, there was a further sum of $25,000 appropriated for the work, and during the last fiscal year the jetty was extended to a distance of 2,894 feet from the shore. Including the stone and timber work at the inner end, the total length of the jetty on June 30, 1883, was 3,075 feet.

Frequent surveys have been made to discover what changes were taking place in the channel and on the shores near the work. The large deposits of sand in the angle formed by the jetty and the shore to the westward still continue. Only minor changes have occurred in the channel, and these changes have not been constant. On the whole, there seems to have been a slight deepening, but by reason of the irregularity of the changes, there has been no increase in navigable capacity. It was not anticipated that any marked change would occur before the jetty reached the outer bar, from which, or rather from the outer 12-foot curve, the end of the jetty is now 2,785 feet distant, and it was thought that it might be found even there that a second jetty, starting from Coatue Point, on the east side of the entrance, would be necessary.

It is proposed, with the remainder of the funds available, to extend the west jetty toward the outer bar, and to continue the comparative surveys and the observations necessary to determine the velocity and amount of tidal flow, to furnish data on which to fix the width of channel, and the location of the east jetty, should it be found that it will be required. The inner harbor of Nantucket is deep and capacious, and is admirably situated for a harbor of refuge, but its use as such is now prevented by the shoal water at its mouth. The original estimate of the cost of the work, including both jetties, was $224,000. Of this amount there has been appropriated $100,000, leaving $124,000 to complete.

July 1, 1882, amount available		$45,792 15
Amount appropriated by act passed August 2, 1882		25,000 00
		70,792 15
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$22,509 73	
July 1, 1883, outstanding liabilities	14,051 42	
		36,561 15
July 1, 1883, amount available		34,231 00
Amount (estimated) required for completion of existing project		124,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		60,000 00

(See Appendix C 2.)

3. *Wood's Holl and Harbor of Refuge, at Wood's Holl, Massachusetts.*— The name Wood's Holl is applied to a strait connecting the waters of Buzzard's Bay and Vineyard Sound, and also to a harbor situated on the strait. This harbor is divided into Great Harbor and Little Harbor.

Estimates for several improvements of the strait were submitted in 1873, varying in cost between $5,000 and $446,000.

In 1878 an appropriation of $15,000 was made for clearing it of the rocks most in the way of existing steamboat navigation and for deepening the entrance to Little Harbor.

The amount expended up to June 30, 1880, was $13,378, of which about $4,000 was expended in deepening the entrance to Little Wood's Holl Harbor to 10 feet at mean low water for a width of 130 feet. The mean rise of the tide is 1.65 feet in Little Harbor. This latter work was mainly for the light-house depot located there, and it enabled light-ships to enter. The work done in the strait relieved the navigation through it of its worst obstructions.

The amount expended during the year ending June 30, 1881, completed the removal of the rocks in the strait, which the existing steamboat lines desired removed, and the navigation is now regarded by their managers as safe, so that this partial project is complete.

During the fiscal year ending June 30, 1882, a survey of the northern shore of "Great Harbor" was made, and in obedience to a resolution of the House of Representatives dated January 11, 1882, a report on, with estimates of the cost of, a breakwater in "Great Harbor" was submitted.

Congress, by act of August 2, 1882, appropriated $52,000 for construction of a harbor of refuge.

The estimate for this work contemplated the construction of a breakwater pier, a basin for the use of the United States Fish Commission, and wharves for the use of that Commission and other branches of the public service. The land required for the proposed works on the shore of the Great Harbor of Wood's Holl having been provisionally acquired by the Commission, the title was finally secured to the United States on the 20th of April, 1882, but the opinion of the Attorney-General on its validity was only obtained on the 2d of June, 1882.

A general law of the United States prohibiting any expenditure upon land before action on the title by the Attorney-General, the work could not be advertised or let before that date, and the only work accomplished during the fiscal year was the removal of the bowlders, some of them of large size, which thickly covered the site of the pier and wharves in depths varying from 3 to 20 feet at mean low water; the preparation of the proposed contract and the specifications for the masonry work, and the issuing of advertisements on the 4th of June, 1883, for proposals for the execution of this work. By the terms of the proposed contract the work is to commence on or before the 9th of August, 1883, and be completed within twelve months thereafter.

Judging from the lettings of similar kinds of work in this district, the officer in charge is of the opinion that the current appropriation will only be sufficient for the work provided for in the proposed contract, and that the wharves, the filling in behind the retaining-walls, and the dredging which will be required inside the hollow pier and in front of the wharves, will require an additional appropriation of $25,000.

Near the harbor of Wood's Holl is a strait of that name which is one of the most important of the entrances into Buzzard's Bay. The channel is narrow, and the currents are swift and irregular. The late General Warren some years since submitted a project for the improvement of this strait, which was printed in House Ex. Doc. No. 84, Forty-third Congress, first session, and in 1878, as before stated, an appropriation of $15,000, a part of which was to be applied to this work, was made, but it was sufficient only for the removal of some of the most dangerous of the rocks. For the completion of this work there will be required, according to the original estimate, $431,000. If this work is to be undertaken, the amount that can be profitably expended in fiscal year ending June 30, 1885, is $100,000.

July 1, 1882, amount available		$567 07
Amount appropriated by act passed August 2, 1882		52,000 00
		52,567 07
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$2,139 73	
July 1, 1883, outstanding liabilities	436 24	
		2,575 97
July 1, 1883, amount available		49,991 10
Amount (estimated) required for completion of existing project		25,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		25,000 00

(See Appendix C 3.)

4. *Wareham Harbor, Massachusetts.* (In charge of Maj. F. Harwood, Corps of Engineers, until his death, March 26, 1883.)—This harbor is an estuary of Buzzard's Bay. It is about 13 miles east of the harbor of New Bedford. It is from 200 feet in width in the upper part to more than one-half mile in width in the lower part, and is separated from Buzzard's Bay by Long Beach, with a channel 500 feet wide to the west of it.

Before any improvement was made, the ruling depth in the harbor was about 7 feet at mean low water in a narrow and very crooked channel. The mean rise of the tide is 4 feet.

The original project adopted in 1871 was to straighten the channel, widen it to 100 feet in the upper and to 300 feet in the lower part, and deepen it to 9 feet at mean low water. It was modified so as to increase the depth of channel in the lower part to 10 feet at mean low water. It was completed in 1876. The amount expended prior to June 30, 1880, was $40,000.

This improvement allowed coasters of 13 feet draught to reach the wharves at high water without the aid of steam-tugs.

A plan with estimate of $44,050 for further improvement was transmitted to Congress to comply with requirements of the river and harbor act of June 14, 1880. This plan provided for making a channel 250 feet wide and 10 feet deep at mean low water, from Barney's Point to the entrance of the harbor. Above Barney's Point the width of the proposed channel was to be 350 feet. The plan also included the strengthening of the sand-catch fence on Long Beach, which had been built in 1877–'78.

Congress, by act of March 3, 1881, appropriated $10,000 for this work.

The money was expended in dredging, under contract, through the upper bar, and in strengthening the sand-catch fence on Long Beach.

By act of Congress of August 2, 1882, $5,000 was appropriated, and it being considered that the amount would be insufficient to warrant an attempt to continue the work of deepening the harbor, which constituted the main feature of the original project, the operations of the fiscal year have been confined to the work of protection of Long Beach, a long, narrow strip of land which separates the harbor and Buzzard's Bay, and is but a few feet above the level of the sea. It had been found that the sand abraded by the sea on the outside was washed around the point into the harbor and decreased the depths which had been gained by dredging under former appropriations.

In continuation of work of former years, there was built during the year 1,100 running feet of sand-catch walls of stone and brush and 1,864 running feet of wooden sand-catch fence, such as has been successfully used on the shores of the western lakes. The latter kind of fence has not proved as successful as was anticipated, and no more of it will be built at Long Beach until further experience is had of its merits at this locality. With the remainder of the funds available it is proposed to extend the stone and brush sand-catch wall just built 310 feet farther to the eastward; to build six spurs or short jetties running westward from the stone and brush sand-catch wall which has been constructed across the west end of the beach; to build out from the south side four additional stone and brush spurs or jetties of an aggregate length of about 500 feet, and to fill inside the triangular frames on which the wooden sand-catch fence was built with brush, to catch the sand which is now washed through that fence by the waves from seaward.

The original estimate of the cost of the work of improvement at

Wareham was $44,050. Of this amount there has been appropriated $15,000, leaving $29,050 as necessary to complete.

July 1, 1882, amount available		$397 45
Amount appropriated by act passed August 2, 1882		5,000 00
		5,397 45
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,020 13	
July 1, 1883, outstanding liabilities	386 06	
		3,406 19
July 1, 1883, amount available		1,991 26
Amount (estimated) required for completion of existing project		29,050 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		15,000 00

(See Appendix C 4.)

5. *Taunton River, Massachusetts.*—This river rises in Norfolk County, Massachusetts, and empties into Mount Hope Bay, a name given to that part of Narragansett Bay lying mainly in Massachusetts. Taunton River is about 44 miles in length, measured along its course.

The condition of the river, before its improvement was commenced, was as follows: Beginning at the mouth near the city of Fall River for 6 miles to Somerset, it had sufficient width and depth for the largest coasting vessels. At Somerset it is crossed by a railroad bridge with two very narrow draw-openings. Thence to Dighton, a distance of 2 miles, the ruling depth was about 11 feet at mean high water. From Dighton to Berkeley Bridge, about 1 mile, the channel-way was narrow and obstructed by bowlders, with a depth of not more than 7½ or 8 feet at mean high water. Berkeley Bridge has but one available draw-opening; this is 50 feet wide. From Berkeley Bridge to Weir, a distance of 5 miles, the channel depth was not in places more than 5 feet at mean high water. A vessel of 30 tons burden was as large as could go up to Weir. Just above Weir a bridge, without a draw, crosses the river.

In 1870 an appropriation was made by Congress to increase the depth by dredging to 4½ feet at mean low water, with the expectation that at high water the depth would be 9 feet. This was based upon the rise of tide of 5¼ feet as determined at Dighton. In 1872 observations were made for rise of tide at various points on the river from Dighton to Weir. From these observations it was found that the rise of tide decreased from 5¼ feet at Dighton to 3.4 feet at Weir. This difference in the rise of tide necessitated increased dredging in the upper part of the river to secure the desired navigable depth of 9 feet at mean high water. The first project was completed in the fiscal year ending June 30, 1880. In 1880 Congress made an appropriation of $17,500 to increase the depth from 9 feet to 11 feet at mean high water.

The amount expended to June 30, 1880, was $63,000. The river had at that time a navigable depth of 10 feet at mean high water from Dighton to Berkeley Bridge, and thence to Weir 9 feet, with a channel width of 60 feet in its narrowest parts.

By act of Congress approved March 3, 1881, $25,000 was appropriated for this work, and during the fiscal year ending June 30, 1881, a channel 11 feet deep at mean high water was carried from the bridge at Weir down the river to "John R's" Shoal, a distance of about half a mile. This increased depth was not available in bringing in vessels of increased draught, but it gave loaded vessels a greater depth to lie in, so that they were less liable to injury from grounding while waiting to be unloaded.

By act of Congress of August 2, 1882, there was appropriated $25,000 for continuing this improvement.

During the fiscal ending June 30, 1883, the work of extending the 11-foot channel at mean high water down to The Needles has been completed, with the exception of a small amount of excavation at the fishery near North Dighton, which was left until after the fishing season was over. Work has been commenced on the dredging of the rocky material which formed The Needles and Briggs' Shoal, and it is still in progress. There is now a continuous channel 11 feet deep at mean high water, from the bridge at Weir to Briggs' Shoal, a distance of 3 miles, but there are many scattering bowlders in the channel and on its sides.

With the remainder of the funds available, it is proposed to finish the work near North Dighton to continue the excavation of the rocky material at The Nook and at Wikamount, and the work of ordinary dredging at Berkeley Bridge Shoal, at Wikamount, and between Peter's and Ferry points; and as far as practicable the bowlders left in the dredged channel will be removed. The channel above Berkeley Bridge Shoal is 60 feet, and through that shoal and below it is to be 80 feet wide, with additional width at the bends. In the latter section it is to be 12 feet deep at mean high water.

July 1, 1882, amount available		$23,702 36
Amount appropriated by act passed August 2, 1882		25,000 00
		48,702 36
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$20,723 12	
July 1, 1883, outstanding liabilities	7,040 89	
		27,764 01
July 1, 1883, amount available		20,938 35
Amount (estimated) required for completion of existing project		26,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		26,500 00

(See Appendix C 5.)

6. *Pawtucket (Seekonk) River, Rhode Island.*—This is an estuary forming the continuation of Providence River from Providence to Pawtucket, a distance of 5 miles, and forms a shoal tidal basin of about 1½ square miles. The ruling low-water channel depth before it was improved was about 5 feet. The mean rise of the tide is 4.8 feet at Pawtucket.

The dredging was begun in 1867 to secure a ruling depth of 6 feet at mean low water. It was found to silt up at places and the dredging was repeated. The project was modified to make a ruling mean low-water depth of 7 feet with a least channel width of 75 feet, and to include the clearing out of the east draw-span of the Red Bridge. This was practically completed in 1875.

The amount expended up to June 30, 1880, was $51,470.72, and since that date no work has been done.

The mouth of the river is obstructed by two bridges with badly-arranged draws; but Washington Bridge, which interferes with navigation more than the other (the railroad bridge), is to be rebuilt under an act passed by the legislature of Rhode Island at the January session of 1883, and the obstruction caused by this bridge, which has heretofore been a bar to recommendations by the engineer officer in charge of the district for further appropriations for the improvement of the river, will now be removed.

Pawtucket is largely engaged in commerce and manufactures, and

the larger size and draught of sailing vessels of late years make it desirable that the navigable depth of the river should be increased.

July 1, 1882, amount available	$529 58
July 1, 1883, amount available	529 58

(See Appendix C 6.)

7. *Providence River and Narragansett Bay, Rhode Island.*—Providence River is an estuary of Narragansett Bay, extending from Nyatt Point to the city of Providence. Its length is about 7 miles, with a width varying from 1,000 feet to 2 miles, and a depth in the channel-way from 20 to 50 feet at mean low water. Near its head this estuary is joined by another, called the Seekonk or Pawtucket River, extending 5 miles farther to the town of Pawtucket. The mean rise of the tide is 4.7 feet.

Before any improvement was made, in 1853, the ruling low-water depths were as follows: By using the middle entrance to Narragansett Bay, the deepest draught vessels could ascend as far as Gaspee Point, where the water shoals to a depth of 21 feet at mean low water. This is about 5 miles from Providence. Between Gaspee Shoal and Pawtuxet Shoal at Sabin's light, a distance of about half a mile, the channel is from 23 to 37 feet deep and about 500 feet wide. Pawtuxet Shoal had but about 18 feet depth at mean low water. Between Pawtuxet Shoal and Field's Point, a distance of about 1½ miles, the depth varied from 23 to 45 feet at mean low water, having a least width of 200 feet. This reach had in it Bulkhead Rock, with deep water around it, but with only 7 to 8 feet at low water upon it. Not far above Field's Point the channel depth shoaled to about 16 feet at mean low water. Finally, on reaching the "Crook," at the junction of the Seekonk with the Providence River just below the city wharves, the available low-water depth was reduced to about 4½ feet.

The original project was to deepen the channel at the "Crook" to 9 feet at mean low water. This was dredged in 1852–'53 under an appropriation of $5,000.

The next project was, in 1867, to increase the depth at the "Crook" to 12 feet at mean low water; $23,000 was then expended at this place in dredging to a depth of 12 feet and width of 200 feet, and $2,000 in removing a wreck from Sabin's Point.

The next project was to increase the depth at the "Crook" to 14 feet at mean low water. For this purpose an appropriation of $5,000 was used in 1870, making a channel having that depth for a least width of 130 feet.

In 1872 an appropriation of $10,000 was made, which was all expended in widening the channel-way of 12 feet depth at the "Crook."

In 1873 an appropriation of $10,000 was made to cut off the "Point of Long Bed," which projected into the channel from the east side, just below "Sassafras Point light." With this the worst of the point was removed.

The removal of Bulkhead Rock, in Providence River, was begun in 1870, and $2,500 was then expended in increasing the depth on it from about 8 feet to about 14 feet at mean low water.

The foregoing expenditures amounted in the aggregate to $59,000, and had all been directed toward improving the navigation for coasting vessls.

In 1878 a project was adopted having in view the excavation of a capacious channel, suitable for large ocean steamers, and a much enlarged width for coasters. It is designed to secure a central depth of 23 feet at mean low water for a width of 150 feet, a depth of 12 feet

for a width of 940 feet, and a depth of 6 feet for a width of 1,060 feet. The depths are to increase gradually from the shoalest to the deepest water. The cost was estimated at $500,000.

The work was begun in 1878 under an appropriation of $50,000 for dredging and $5,000 for increasing the depth on Bulkhead Rock. The dredging was begun, under contract, that year and abandoned by the contractor. In 1879 an additional appropriation of $60,000 was made.

Up to June 30, 1880, there had been expended $61,757.79. By this expenditure the channel was made 23 feet deep for a width of 70 feet through the Pawtuxet Shoal—not wide enough to be of practical value. A channel 20 feet deep and 200 feet wide was made through the shoals above Field's Point, which was immediately available. It was reserved till later to make the 23-foot channel depth above Field's Point.

The amount expended during the fiscal year ending June 30, 1881, including the removal of Bulkhead Rock so as to give a depth over it of 20 feet at mean low water, was $79,072.69. In this time the 23-foot low-water channel through the Pawtuxet Shoal was increased to a width of 200 feet, and the 20-foot channel through the shoals above Field's Point to a width of about 450 feet.

An additional appropriation was made in 1881 of $60,000, so that the balance on hand June 30, 1881, was $85,412.58. This was expended during the fiscal year ending June 30, 1882, in increasing the width of channel of 12 and 14 feet at mean low water.

By act of Congress of August 2, 1882, $125,000 was appropriated, and during the fiscal year ending June 30, 1883, the work has been prosecuted under a project for making a 25-foot channel 300 feet in width from Fox Point, in the city, of Providence, to the deep water of Narragansett Bay. With a view to economy of excavation and facility of lighting the channel by a system of range or leading lights, such as have been found necessary in similar cases in Chesapeake Bay, Delaware River, and other localities, it has been laid out in a series of straight reaches with widenings at the bends. The following are the widths gained during the year with a least depth of 25 feet at mean low water:

In the upper reach, or the Fox Point Channel, 180 feet; in the next reach, or the Sassafras Point Channel, 230 feet; in the next reach, or the Field's Point Channel, 200 feet; in the next reach, or the Pomham Channel, no work was done; in the next reach, or the Pawtuxet Channel, 120 feet; and in the next reach, or the Gaspee Channel, 200 feet. With the remainder of the appropriation it is proposed to continue the excavation of the 25-foot channel, and it is anticipated that something in excess of 200 feet of the 300 feet of width proposed for that channel will be finished with the current appropriation. It is also proposed, if the funds will allow, to dredge to a shallower depth some hard material off the point of Long Bed which lies to the eastward of the Field's Point Channel, and is an obstruction to coasting vessels beating in and out of the harbor.

The approved project for the improvement of Providence River, besides the 25-foot channel 300 feet wide, provided for the excavation of a large anchorage basin above Field's Point, a portion of which has been executed. The officer in charge is of the opinion that there is further required an enlargement of the channel below Field's Point to provide beating room for the smaller vessels used in the local trade and coasting traffic. This enlargement, he anticipates, will cost $115,000. The completed channel below Field's Point, as designed by him, would be of the following form in sections: 300 feet wide, 25 feet deep; 500 feet wide, 18 feet deep; 700 feet wide, 14 feet deep. The estimated

cost of the approved project was $675,000. Add the $115,000 mentioned above, and we have $790,000 as the cost of the completed work. Of this amount there has been appropriated $355,000, leaving $435,000 as the sum necessary to complete.

July 1, 1882, amount available		$3,464 49
Amount appropriated by act passed August 2, 1882		125,000 00
		128,464 49
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$75,378 67	
July 1, 1883, outstanding liabilities	16,921 84	
		92,300 51
July 1, 1883, amount available		36,163 98
Amount (estimated) required for completion of existing project		320,000 00
Amount (estimated) required for additional work		115,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		150,000 00

(See Appendix C 7.)

8. *Newport Harbor, Rhode Island.*—This harbor is on the main entrance to Narragansett Bay, which is defended by Fort Adams. It is one of the most important harbors on the coast, furnishing a safe roadstead and anchorage for all classes of vessels. Newport itself is upon an inner harbor admitting the largest vessels, but its capacity is limited by shoals, so that it is no longer adequate for the convenience of the greatly increasing number of vessels seeking it.

Prior to 1872 the general business wharves of the city did not admit of the approach of vessels at low-tide of greater draught than 8 feet. The mean rise of the tide is about $3\frac{3}{4}$ feet.

The first projected improvement was to increase the depth of the approaches to the harbor-line for wharves to 12 feet at mean low water, and to prevent the sand from being brought in around the south end of Goat Island. It was prepared to comply with requirement of the river and harbor act of June 10, 1872. The project, with some modifications, was completed in the fiscal year ending June 30, 1876. The amount appropriated and expended up to that time was $28,500. The results obtained were satisfactory, and the work remains in good condition.

In December, 1880, another project was estimated for, under resolution of the House of Representatives, to increase the anchorage depth in the inner harbor down to 13 feet at mean low water where hard material did not exist, to the extent of 327,000 cubic yards, at a cost of $72,000. For this purpose an appropriation was made in March, 1881, of $25,000. The work was commenced under contract in July, 1881, at the price of 11 cents per cubic yard. It was continued until December 17, 1881, when the contract was annulled by mutual consent, as the material to be excavated proved to be harder than the specifications contemplated.

The engineer in charge then revised his estimate for this improvement, increasing the amount for new requirements about 80,000 cubic yards, and the cost from 14 and 18 cents per cubic yard to 21 and 27 cents per cubic yard, because of the hardness of the material to be dredged and the enhanced prices.

A new contract was also made February 14, 1882, at 19.9 cents per cubic yard, and at the date of the last annual report it was in progress. It was completed October 24, 1882, by the removal of 56,860 cubic yards in addition to the amount reported for the last fiscal year. The entire work done under this contract was in that part of the harbor which lies between Long and Commercial wharves.

By act of Congress of August 2, 1882, $20,000 was appropriated for continuing the improvement of this harbor, and on the 30th of October, 1882, a contract was entered into for dredging to 13 feet at mean low water, two-thirds of the total quantity to be removed from the area between the harbor line, the curve of 13 feet depth, Long Wharf, and Lime Rock, and the remaining one-third from the spit south of Goat Island. The total quantity removed under this contract, which was completed June 25, 1883, was 73,535 cubic yards. The anchorage capacity of the inner harbor, with a least depth of 13 feet at mean low water, was increased during the fiscal year about ten acres, and the harbor entrance between Lime Rock and Goat Island has been increased during the same time about 250 feet in width between the curves of 13 feet at mean low water. This widening required dredging over an area of about 4.6 acres.

The estimated cost of the project under which the improvement of Newport Harbor is carried on was $132,000. This amount should be increased by $6,000 required for additional jetties on the west side of Goat Island to arrest the drift of gravel and sand into the south entrance to the harbor. There has been appropriated $45,000, leaving $93,000 as necessary to complete.

July 1, 1882, amount available		$8,041 05
Amount appropriated by act passed August 2, 1882		20,000 00
		28,041 05
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$23,552 24	
July 1, 1883, outstanding liabilities	4,130 04	
		27,682 28
July 1, 1883, amount available		358 77
Amount (estimated) required for completion of existing project		87,000 00
Amount (estimated) required for additional work		6,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		50,000 00

(See Appendix C 8.)

9. *Block Island Harbor, Rhode Island.*—This island is a part of the State of Rhode Island, and its nearest point is about 10 miles south of the mainland. It is about 14 miles east of Montauk Point, on Long Island, and has deep water all around it.

The harbor is an artificial one, built for local purposes by the United States, in the years 1870 to 1879 inclusive, at a cost of $285,000. It is on the east side of the island, towards the southern part, and is formed by a riprap breakwater, to intercept the waves from the eastward, and has an inner harbor next the inside shore end of the breakwater, forming a basin about 250 feet by 300 feet, which was originally dredged to a depth of 7 feet at mean low water. This latter in active seasons of the year is crowded to its full capacity. The mean rise of the tide is about 3 feet.

Before this work was built no decked vessels could find harbor on the island in a storm, and none were owned there. The local business so increased that in February, 1880, an estimate was called for to increase the entrance to and depth inside the inner harbor to 9 feet at mean low water. The act of June 14, 1880, appropriated $6,000 for this purpose and to remove a small wreck. The desired improvements were all completed during the fiscal year ending June 30, 1881, and included the removal of two large bowlders (then but recently discovered) within the sheltered area.

This work may be considered as permanent (except that of the inner

harbor, which is a timber crib-work), but it is probable that with the growth of commerce frequent extensions will be required. Its capacity is now hardly equal to the local wants. Besides the wants of the mackerel-fishing fleet and the general coast navigation, the island is an important point on our shores for ocean navigation. It has a signal station connected by submarine telegraph with the mainland. Vessels are passing the island at all times and on all sides of it, and its position renders it of national importance.

By act of Congress of August 2, 1882, $19,000 was appropriated for this work, and contracts were entered into April 10, 1883, for the construction of a harbor wall of coursed granite to replace the crib-work filled in with stone which formed the east side of the inner harbor, and which had become so much decayed as to endanger it, and for furnishing granite riprap for the construction of a jetty extending from the foot of the cliff which lies to the southward and eastward of the harbor of refuge. This cliff is undermined by the sea at high tides, and the *débris* was carried by the shore current through the breakwater into the harbor of refuge.

The construction of the jetty will prevent this action for some time, but the degradation of the cliff is so rapid, and the amount of sand and clay brought down is so great, that the jetty will soon be filled on the southerly side, and it will probably be but a temporary expedient.

The construction of both the harbor wall and the jetty was in progress at the end of the fiscal year. The engineer officer in charge states that the crib-work in the west and north sides of the inner harbor should also be replaced by walls of stone, as they are rapidly decaying, and that the Government wharf (of wood), on the south side of the inner harbor, should be replaced by a stone-retaining wall with earth filling behind it. At this wharf all the freight carried to and from the island is brought, and at it are landed all the supplies for the light-houses on the island, and also the United States mails.

The cost of these works is estimated at $30,000. Thirty-five thousand dollars could also be expended in the next fiscal year to advantage in the extension of the breakwater to secure additional shelter, and in this way relieve the inner harbor, which is at times too small to hold the vessels which seek it for shelter.

July 1, 1882, amount available		$65 14
Amount appropriated by act passed August 2, 1882		19,000 00
		19,065 14
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,244 85	
July 1, 1883, outstanding liabilities	1,716 62	
		4,961 47
July 1, 1883, amount available		14,103 67
Amount (estimated) required for additional work		65,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		65,000 00

(See Appendix C 9.)

10. *Little Narragansett Bay, Rhode Island and Connecticut.*—Little Narragansett Bay is at the mouth of the Pawcatuck River, and lies between Stonington and Watch Hill. The navigable draught of water before any improvements were made was 4½ feet at mean low water.

The Pawcatuck River, which has been improved by the United States up to Westerly, and has now a channel 75 feet wide and 5½ feet deep at mean low water, can only be approached through this bay.

The original project for improving the bay, adopted in 1878, provides for a channel across the bay 200 feet wide and 7½ feet deep at mean low water; also, for the removal of some rocks.

The amount expended up to June 30, 1881, was $20,288.71. The work accomplished had made a channel through the hard material at the east end 185 feet wide, and through the rest of the channel 60 feet wide. The channel was as yet in part too narrow to be of much use to navigation. The width of channel was increased from 60 to 140 feet. The rocks off the east entrance of the new channel, and the worst of those at the entrance to the inside landing at Watch Hill, were removed.

By act of Congress of August 2, 1882, $6,000 was appropriated for this improvement, and a contract was entered into October 30, 1882, for widening the channel made by former appropriations from Pawcatuck Point to the deep water to the west, 20,867 cubic yards were dredged during the fiscal year, and a quantity of rocky material not included in the contract was removed, thus completing the project for a channel through the bay 200 feet wide and 7½ feet deep at mean low water. There are, however, some bowlders which were left on the bottom and on the sides of the channel, and there are also many bowlders in the Watch Hill Channel. The former will be entirely removed, and the latter as far as practicable, with the funds remaining on hand, as soon as the summer use of the channel by steamers is over.

The completed channel, for which good ranges on shore should be provided, will enable steamers and vessels drawing from 9 to 10 feet of water bound for the Pawcatuck River and Westerly, and also to Watch Hill, to cross the bay; and they can now take advantage of the improvements made some years since by the General Government in the Pawcatuck River.

July 1, 1882, amount available		$277 88
Amount appropriated by act passed August 2, 1882		6,000 00
		6,277 88
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$4,942 84	
July 1, 1883, outstanding liabilities	199 20	
		5,142 04
July 1, 1883, amount available		1,135 84

(See Appendix C 10.)

11. *Stonington Harbor, Connecticut.*—Originally this harbor was an open bay, unprotected from southerly storms and obstructed by a middle ground having at low water a depth of but 6 feet at the shoalest part. This middle ground nearly filled the harbor and left but a narrow channel on either side of insufficient depth to permit vessels of 12 feet draught to reach the upper wharves at low water. A small breakwater, or pier, costing $36,753, was built in 1828–'30 from the east shore about half way up the harbor, to protect the commerce of the village.

Plans for more extensive improvements were considered in 1872, the object being to afford by means of additional breakwaters a large anchorage to serve as a harbor of refuge for general commerce, and also, by dredging, to secure an increased depth in the upper harbor for the accommodation of the local shipping interest.

During the season of 1873–'74, $45,000 was expended in dredging, which resulted in the enlargement of the channel to the steamboat wharf by removing the northern portion of the middle ground to a depth of 12 feet. Subsequently a breakwater 2,025 feet in length, costing $103,190, was built off Wamphassuck Point, the southwestern limit

of the harbor, and a similar work on a line running from Bartlett's Reef to the middle ground, to serve as a protection from southerly storms, was commenced, and 1,070 running feet were constructed by means of the appropriations of $25,000, June 14, 1880, and $30,000, March 3, 1881. The completion of the latter breakwater will afford a harbor of refuge of large dimensions, thoroughly sheltered, and an available anchorage for vessels drawing 18 feet of water.

By the act of Congress of August 2, 1882, $25,000 was appropriated for continuing the construction of this breakwater and a contract was entered into October 18, 1882, for the delivery of granite. It having been found that the heavy seas which rolled in around the eastern end of the breakwater would make it necessary to carry it to the eastward as far as Bartlett's Reef, the extension in this direction was continued until early in June, 1883, when work was commenced on the western extension toward the middle ground. The eastern end is now about completed, but the exact position in which to leave it cannot be determined until a survey is made. The length of breakwater gained during the fiscal year was 451 feet, of which 406 feet were at the eastern end and 45 feet were at the western end. The total length of the breakwater on the 30th of June, 1883, was 1,521 feet. The delivery of granite during the fiscal year was 16,413 tons.

To carry the breakwater to the middle ground there yet remains to be constructed about 850 running feet. The original estimate of the cost of this breakwater was $100,000. This should be increased to $130,000, by reason of the extension eastward to Barlett's Reef. Of this amount there has been appropriated $80,000, leaving $50,000 as necessary to complete.

July 1, 1882, amount available		$680 44
Amount appropriated by act passed August 2, 1882		25,000 00
		25,680 44
July 1, 1883, amount expended during fiscal year exclusive of outstanding liabilities July 1, 1882	$15,540 46	
July 1, 1883, outstanding liabilities	4,025 36	
		19,565 82
July 1, 1883, amount available		6,114 62
Amount (estimated) required for completion of existing project		50,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		50,000 00

(See Appendix C 11.)

IMPROVEMENT OF HARBORS AND RIVERS ON LONG ISLAND SOUND.

Officers in charge, Maj. J. W. Barlow, Corps of Engineers, to May 23, 1883, since which time Maj. Walter McFarland, Corps of Engineers.

1. *Thames River, Connecticut.*—The plan for this improvement, adopted in 1882, contemplates the construction of a series of five longitudinal training-walls extending along the outer sides of curves of the channel and the dredging necessary to make a channel 200 feet wide and 14 feet deep at mean low water; the section of the river where improvement is needed is about 3½ miles in length, extending south from the city of Norwich.

The total amount appropriated for this river to the present time is $256,800. It has been expended in making and maintaining a depth of 14 feet below high water, subsequently increased to 14 feet below mean low water, by means of wing-dams, training-walls, and dredging.

The operations of the past fiscal year have been the removal of 53,197

cubic yards of sand from the channel near Thamesville and from opposite Trading Cove, resulting in a depth of 14 feet at mean low water. The width at Thamesville is 100 feet, and that at Trading Cove will be made the same under the present contract. The training-wall on Trading Cove flats was completed, its full length being 2,370 feet. The training-wall below Fort Point is under contract for completion; work upon it has been begun, but no part is yet fully completed.

Besides being an important manufacturing city itself, Norwich is a center for distribution of coal and raw materials to a large manufacturing district comprising the northeast part of Connecticut and the south-central part of Massachusetts.

July 1, 1882, amount available		$28,974 72
Amount appropriated by act passed August 2, 1882		35,000 00
		63,974 72
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$21,438 40	
July 1, 1883, outstanding liabilities	2,114 66	
		23,553 06
July 1, 1883, amount available		40,421 66
Amount (estimated) required for completion of existing project		153,080 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		100,000 00

(See Appendix D 1.)

2. *New London Harbor, Connecticut.*—The project for improving this harbor was adopted in 1880. It provides for the removal of the southern part of a shoal east of the railroad wharf, giving a depth of 16 feet at mean low water.

To the present date $15,800 have been appropriated for this work, and has resulted in securing the required depth over about two-thirds of the area.

During the past fiscal year 636 tons of bowlders and 9,794 cubic yards of stones and sand were removed from the shoal to the depth of 16 feet.

This is the only work of improvement which the Government has ever undertaken in this harbor, and it is not probable that anything more than this project contemplates will be asked for.

July 1, 1882, amount available	$158 89
Amount appropriated by act passed August 2, 1882	9,000 00
	9,158 89
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	9,075 01
July 1, 1883, amount available	83 88
Amount (estimated) required for completion of existing project	8,200 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	8,200 00

(See Appendix D 2.)

3. *Connecticut River.*—(In charge of Lieut. Col. G. K. Warren, Corps of Engineers, until his death, August 8, 1882, and of Lieut. Col. G. H. Elliot, Corps of Engineers, to May 26, 1883.)

Above Hartford, Connecticut, and below Holyoke, Massachusetts.—From Hartford to Windsor Locks at the foot of Enfield Falls, a distance of $10\frac{3}{4}$ miles, the river has a sedimentary bed and banks, and is naturally shoal at low water, having sometimes, where not improved, a depth of

only 18 inches. Enfield Falls, a rocky rapid extending 5¼ miles, prevents all navigation at the present time; but vessels drawing 3 feet can pass around them by means of a canal, having locks 80 feet by 18 feet. This canal is owned by a corporation which collects toll from boats passing through. It is mainly used to furnish water power. From the head of the Falls to Holyoke the navigation is good, having a low-water depth of not less than 5 feet. There is seldom any useful tide above Hartford.

A project for permanently improving this section of the river, so as to pass vessels of 8 feet draught to Holyoke, was submitted in 1878, the most important feature of which was the construction of a canal to pass Enfield Rapids. Revised estimates for this canal, designed to bring it from the head of the rapids to deep-water at Hartford, avoiding several troublesome shoals, were submitted in 1881. The estimated cost of the this canal is $1,322,800.

Nothing has yet been done towards this construction, the funds available not being sufficient to warrant its commencement. The funds remaining on hand from previous appropriations will be sufficient for any temporary improvement that may be required during the ensuing year.

The construction of the canal should be completed within about three years from its commencement, and it ought not to be begun with less than one-third the full estimate, about $450,000.

The benefit to be secured by a permanent improvement would be the reduction of the cost of transportation of bulky articles to a large manufacturing region now wholly dependent upon railroads. This region includes the city of Springfield, where is a United States armory, Holyoke, and other smaller places.

Hartford, Conn., and Holyoke, Mass.

July 1, 1882, amount available	$13,669 80
July 1, 1883, amount available	13,669 80
Amount (estimated) required for completion of existing project	1,322,805 00

Above Hartford and below Enfield Falls.

July 1, 1882, amount available	$1,912 66
July 1, 1883, amount available	1,912 66

On or above Enfield Falls, and below Holyoke, Mass.

July 1, 1882, amount available	$10,702 92
July 1, 1883, amount available	10,702 92

(See Appendix D 3.)

Below Hartford, Connecticut.—In 1880 a project was adopted looking to the permanent improvement of this section of the river, particularly that part from Hartford to Rocky Hill, by protecting the caving banks with mattresses and by building wing-dams to concentrate the force of the currents. Previous to this dredging had been frequently done to remove the worst shoals, which generally formed again after each freshet. Jetties had also been built for the permanent deepening and straightening of the channel across Saybrook Bar, at the mouth of the river. Under the present project, the only permanent work done during the fiscal year ending June 30, 1882, was the construction of the wing-dam at Glastonbury Bar, 8 miles below Hartford.

The operations of the past year consist of the temporary improvement of Glastonbury Bar, Clay Banks (1½ miles below Hartford), and

Hartford Bar, by dredging under a previous contract, the continuance of dredging on Hartford Bar under a new contract, and in partly constructing the Hartford Bar wing-dam, which will be completed under the contract now in force.

During the ensuing year operations will be confined to work under contracts now in force for dredging in Salmon River and at various shoals in the Connecticut River and for the completion of the wing-dam at Hartford Bar.

It is considered very important that the protection of the caving banks be begun at once, particularly at points where wing-dams have been built increasing the scour and rendering the bank more liable to erosion. For the rapid prosecution of this work, for additions to the Saybrook Bar Jetties, and for such dredging as may be necessary, it is recommended by the officer in charge that the sum of $100,000 be asked for, to be made available as soon as possible.

July 1, 1882, amount available		$8,363 00
Amount appropriated by act passed August 2, 1882		45,000 00
		53,363 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$14,619 56	
July 1, 1883, outstanding liabilities	6,228 97	
		20,848 53
July 1, 1883, amount available		32,514 47
Amount (estimated) required for completion of existing project		273,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		100,000 00

(See Appendix D 3.)

4. *Clinton Harbor, Connecticut.*—This harbor is an open bay, on the north shore of Long Island Sound, at the head of which a narrow channel runs, with a sharp bend to the westward, up a tidal stream, the Hammonasset River. Formerly there was 8 feet depth at low water in the entrance to this channel; forty years ago a breach occurred in the beach, diverting part of the tidal flow, and the entrance to the channel has since shoaled to 4 feet.

The project for improvement adopted in 1882 contemplates the closing of the breach and probably some future dredging.

The present appropriation of $3,000 is the only one ever made for this harbor. Under it, during the ensuing fiscal year, the breach will be closed by a dike of riprap stone.

No satisfactory estimate of the necessity or of the requisite amount of dredging can be made until after the closing of the breach.

Amount appropriated by act passed August 2, 1882	$3,000 00
July 1, 1883, amount available	3,000 00

(See Appendix D 4.)

5. *New Haven Harbor, Connecticut.*—A modification of the original project, adopted in 1878, aims at securing a channel way from the head of the harbor to Long Island Sound, having a width of not less than 400 feet and a depth of 16 feet at mean low water, where the original available low-water depth was 9 feet.

The total amount appropriated for this harbor to the present time is $231,000. By its expenditure the desired depth and width have been obtained, except across Fort Hale Bar.

Operations during the fiscal year ending June 30, 1883, have consisted in preparation of plans and a contract for the commencement of a dike opposite Fort Hale to increase the scour over the bar and make perma-

nent any depth gained by dredging. Work under the contract is just begun, and will be completed during the ensuing year by the construction of the entire shore connection of the dike and about 200 linear feet of the channel dike.

According to a revised estimate $70,000 will be required to complete this dike. Its construction ought to go on continuously until it is completed, in order to prevent a scour at the unfinished end. In addition to this, $30,000 will be required for dredging.

July 1, 1882, amount available		$3,464 96
Amount appropriated by act passed August 2, 1882		30,000 00
		33,464 96
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$2,265 45	
July 1, 1883, outstanding liabilities	2,157 75	
		4,423 20
July 1, 1883, amount available		29,041 76
Amount that can be profitably expended in fiscal year ending June 30, 1885		100,000 00

(See Appendix D 5.)

6. *Breakwater at New Haven, Connecticut.*—In 1879 a project was adopted for making a large and convenient harbor of refuge at New Haven by the construction of two breakwaters at the entrance to the harbor.

The total amount appropriated to the present time is $180,000, and 1,378 linear feet of the east breakwater have been built, using 126,989 tons of riprap stone.

Operations during the past fiscal year consisted in the delivery ot 13,097 tons of stone, building 153 feet of the breakwater. The completion of contracts now in force will leave the work about 1,770 feet in length.

Every consideration that led to beginning the construction of this harbor for refuge applies with equal or greater weight to the rapid prosecution of the work.

July 1, 1882, amount available		$722 34
Amount appropriated by act passed August 2, 1882		60,000 00
		60,722 34
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$13,314 88	
July 1, 1883, outstanding liabilities	5,350 16	
		18,665 04
July 1, 1883, amount available		42,057 30
Amount (estimated) required for completion of existing project		1,131,134 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		500,000 00

(See Appendix D 6.)

7. *Milford Harbor, Connecticut.*—The original project for the improvement of this harbor, adopted in 1872, was completed in 1882, making a channel 4 feet deep at mean low water to the upper wharves, and protecting the east bluffs from erosion. Under an appropriation made by act of Congress, passed August 2, 1882, a new project was taken up contemplating making the channel 8 feet deep and 100 feet wide over the bar at the head of the harbor.

The total amount appropriated for this harbor to the present time is $39,600, which has been expended in carrying out the original project and beginning the channel of 8 feet depth.

During the past fiscal year the 8-foot channel was dredged 40 feet wide about half its contemplated length. Under the contract still in force, this width will be carried through the entire length.

July 1, 1882, amount available		$76 19
Amount appropriated by act passed August 2, 1882		5,000 00
		5,076 19
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$18 13	
July 1, 1883, outstanding liabilities	1,664 95	
		1,683 09
July 1, 1883, amount available		3,393 11
Amount (estimated) required for completion of existing project		6,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		6,000 00

(See Appendix D 7.)

8. *Housatonic River, Connecticut.*—In 1871 a project was adopted contemplating making a channel 7 feet deep and 100 feet wide from the head of navigation to Long Island Sound by means of dredging and of constructing a breakwater on the east side of the channel over the bar at the mouth.

To the present time $68,700 have been appropriated for work in this river, resulting in making the desired depth throughout the river except over the bar at the mouth, where no work has been done nor is any at present projected.

During the past fiscal year no work has been done. The appropriation of $2,000, made by act of Congress passed August 2, 1882, will be expended during the ensuing fiscal year.

Drew's Rock is the occasion of formation of a bar during nearly every freshet. Its removal would be economical compared with the expense of frequent dredging, and it is recommended that this be undertaken.

For the removal of Drew's Rock and dredging necessary to preserve the 7-foot depth, an appropriation of $10,000 is asked.

July 1, 1882, amount available		$115 40
Amount appropriated by act passed August 2, 1882		2,000 00
		2,115 40
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		118 40
July 1, 1883, amount available		1,997 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		10,000 00

(See Appendix D 8.)

9. *Bridgeport Harbor, Connecticut.*—The project for the improvement of this harbor, which contemplated the dredging of a channel 12 feet deep at mean low water and 300 feet wide, was completed at the date of the last annual report. Under an appropriation made by act of Congress passed August 2, 1882, a project was adopted for widening to 600 feet the channel between the Inner Beacon and the Naugatuck Railroad Wharf at an estimated cost of $60,000, the basin so made being desired as a harbor of refuge and relief to the main channel.

The entire amount appropriated for Bridgeport Harbor is $205,000; and this has been expended in completing the first-mentioned project, in building a jetty to arrest the influx of sand from the east, and in beginning the new project.

During the past fiscal year 90,561 cubic yards of mud were removed from the projected anchorage basin, securing a depth of 12 feet at mean low water over an area of about eight acres.

July 1, 1882, amount available	$360 74
Amount appropriated by act passed August 2, 1882	10,000 00
	10,360 74
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	9,533 51
July 1, 1883, amount available	827 23
Amount (estimated) required for completion of existing project	50,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	25,000 00

(See Appendix D 9.)

10. *Southport Harbor, Connecticut.*—The plan for improvement of this harbor was adopted in 1876 and modified in 1880; it comprised repairing the breakwater and dike, built about forty-five years ago, and dredging a channel 100 feet wide and 4 feet deep at mean low water from Long Island Sound to the village.

The total amount appropriated to the present time is $31,087.23. This includes the sums for the original construction of the breakwater and dike, and has sufficed for the completion of the above project as far as seems necessary.

During the past fiscal year 8,390 cubic yards of material have been removed from the channel, which is now 95 feet wide from Long Island Sound to the south end of the breakwater, thence to White Rock 80 feet wide, and thence to the principal landings 50 feet wide, in a channel forked at the end.

No further appropriation is needed at present.

July 1, 1882, amount available	$155 85
Amount appropriated by act passed August 2, 1882	3,000 00
	3,155 85
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	2,841 78
July 1, 1883, amount available	314 07

(See Appendix D 10.)

11. *Norwalk Harbor, Connecticut.*—In 1872 a project was adopted for making a channel, 100 feet wide and 6 feet deep at mean low water, from Long Island Sound to the Norwalk wharves.

The total amount appropriated to the present time is $69,246.66, which has been expended in making the channel 60 feet wide for one-half the distance from Norwalk to South Norwalk, 100 feet wide for the other half that distance, and 75 feet wide with a depth of 8 feet below South Norwalk.

Operations during the past fiscal year have consisted in dredging above the South Norwalk Railroad Bridge, increasing the width from 60 feet to 100 feet, and in the bends to 130 feet, removing 25,003 cubic yards of mud.

July 1, 1882, amount available	$310 19
August 14, 1883, over-payment refunded	296 30
Amount appropriated by act passed August 2, 1882	5,000 00
	5,606 49
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	5,091 14
July 1, 1883, amount available	515 35
Amount (estimated) required for completion of existing project	15,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	15,000 00

(See Appendix D 11.)

12. *Mamaroneck Harbor, New York.*—This is a tidal, inlet opening into a broad bay in the north shore of Long Island Sound, about 5 miles from the Connecticut State line. The available depth at mean low water is 5 feet about half way up this inlet, but to the head of the harbor it is less than 1 foot. There are several rocks in and near the channel which have been the cause of a number of wrecks.

The project for improvement contemplates the removal of the worst of the rocks and dredging to make a channel 100 feet wide and 7 feet deep at mean low water to the old Steamboat Wharf, half way up the inlet, and to make a 4-foot channel 80 feet wide from that wharf to the village.

The present appropriation of $15,000 is the only one ever made for this harbor; with this sum three of the most dangerous rocks will be removed.

The estimated amount required to complete the desired work could be advantageously expended in a single year.

Amount appropriated by act passed August 2, 1882	$15,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	78 60
July 1, 1883, amount available	14,921 40
Amount (estimated) required for completion of existing project	28,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	28,000 00

(See Appendix D 12.)

13. *Port Jefferson Harbor, New York.*—The project for improving this harbor, adopted in 1871 and modified in 1877, consists in making a channel through the entrance of 8 feet depth at mean low water, and in protecting the channel by means of jetties so as to make it reasonably permanent.

Up to the present time $80,200 have been appropriated for this work, with which the east jetty has been carried out to a depth of 10 feet at mean low water, the west jetty to a depth of 6½ feet, and the channel has been dredged to the desired depth.

Operations during the past fiscal year have consisted in repairing and adding to the east jetty, and this is still in progress.

The work is now in condition where it may be safely left for a short time. After due trial some further development of the project may be necessary to secure permanence.

No appropriation is asked for at present.

July 1, 1882, amount available		$421 31
Amount appropriated by act passed August 2, 1882		8,000 00
		8,421,31
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$486 05	
July 1, 1883, outstanding liabilities	5,273 08	
		5,759 13
July 1, 1883, amount available		2,662 18

(See Appendix D 13.)

14. *Greenport Harbor, New York.*—This harbor is near the east end of Long Island, in an inlet known as Shelter Island Sound. It is protected by Shelter Island and Long Island from storms from any quarter but the northeast; and Sterling's Basin, a small indentation in the shore, was covered from the northeast by Joshua's Point. The point has been much eroded of late years and the material washed into Sterling's Basin, so that where West India vessels anchored thirty years ago there is now

scarcely 3 feet of water, the area of the anchorage basin being diminished more than one-half.

The project for improvement, adopted in 1882, consists in constructing a breakwater from Joshua's Point out to the 18-foot curve, to check the erosion and at the same time increase the sheltered area.

The appropriation of $10,000 now available is the only one ever made for this harbor. Work has just begun, and it is estimated that 800 linear feet of the breakwater will be completed under the present contract.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 18-2	$157 09	
July 1, 1883, outstanding liabilities	71 55	
	228 64	
July 1, 1883, amount available		9,771 36
Amount (estimated) required for completion of existing project		36,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		36,000 00

(See Appendix D 14.)

IMPROVEMENT OF HUDSON RIVER—REMOVAL OF OBSTRUCTIONS IN EAST RIVER AND HELL GATE—IMPROVEMENT OF BUTTERMILK CHANNEL, NEW YORK HARBOR; OF GOWANUS BAY AND HARLEM RIVER; OF THE HARBORS OF RONDOUT, ECHO, PORT CHESTER, AND NEW ROCHELLE, NEW YORK, AND OF RARITAN AND SOUTH RIVERS, NEW JERSEY.

Officer in charge, Col. John Newton, Corps of Engineers, with Lieut. G. McC. Derby, Corps of Engineers, under his immediate orders.

1. *Hudson River, New York.*—The original condition of the navigable channel gave between New Baltimore and Barren Island a depth at mean low water of 7½ feet; at Coeyman's, 8½ feet; at Mull's, 9 feet; at Castleton, 8 feet; at Cedar Hill, 7½ feet; at Winnies, 9.4 feet; on the Overslaugh, 7.7 feet; at Cuyler's Bar, 9 feet; at Round Shoal, 7.2 feet. That is, at low-water 7½ feet could be carried from New Baltimore to Albany, and from Albany to Troy 7.2 feet. The channels, however, were very crooked in places, very narrow, and of such difficult navigation that the grounding of boats was, it might almost be said, the rule and not the exception.

The originally adopted project for the improvement was the construction of longitudinal dikes generally of the height of mean high water, to direct the currents and allow the flow over their tops of freshets and of ice.

The amount expended to the close of the year ending June 30, 1882, was $938,336.71. No survey has been made, and the condition of the improvement remains as stated in former reports.

The amount expended during the fiscal year ending June 30, 1883, was $40,390.83, including outstanding liabilities, and cross dikes were completed at Shad Island and Papscanee Island.

The available balance, $16,399.52, will be expended during the year ending June 30, 1884, in the construction of new dikes and necessary repairs to existing dikes.

The estimated amount required for the entire and permanent completion of the work of improvement in accordance with the project of 1868,

and the work proposed in report for the year ending June 30, 1882, is $65,102.46.

July 1, 1882, amount available		$46,790 35
Amount appropriated by act passed August 2, 1882		10,000 00
		56,790 35
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,390 83	
July 1, 1883, outstanding liabilities	37,000 00	
		40,390 83
July 1, 1883, amount available		16,399 52
Amount (estimated) required for completion of existing project		65,102 46
Amount that can be profitably expended in fiscal year ending June 30, 1885		30,000 00

(See Appendix E 1.)

2. *Rondout Harbor, New York.*—The original condition of the navigable channel gave a depth of about 7 feet at mean low water.

The originally adopted project was the prolongation of the channel of Rondout Creek into the Hudson River by the construction of two parallel dikes; also of a branch dike to direct the current of the river and to protect the north dike from the floating ice, and there has been no modification of the original project.

The amount expended to the close of the fiscal year ending June 30, 1882, was $88,731.31; and the depth in the channel was 13½ feet at mean low water.

There has been expended during the year ending June 30, 1883, the sum of $3,508.66, and repairs have been made to the dikes consisting of refilling with stone, replacing fender piles at end of north dike, and raising 600 feet of the south dike to the level of high water.

The estimated amount required for the entire and permanent completion of the work of improvement, in accordance with the approved and adopted project, would be about $2,000, to be used in widening the outlet between the dikes. It was intended to devote the $2,000 appropriated by act of Congress August 2, 1882, to this purpose, but the repairs and raising of the south dike exceeded the amount anticipated.

The project is virtually completed, and will require nothing more than the widening of the outlet between the dikes and the ordinary sum for preservation.

July 1, 1882, amount available		$2,268 69
Amount appropriated by act passed August 2, 1882		2,000 00
		4,268 69
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		3,508 66
July 1, 1883, amount available		760 03
Amount (estimated) required for completion of existing project		2,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		2,000 00

(See Appendix E 2.)

3. *Removing obstructions in East River and Hell Gate, New York.*—The original condition of the channel of East River and Hell Gate was the existence of many large and dangerous rocky obstructions to navigation. The depth over Diamond Reef at mean low water was 17½ feet; over Coenties Reef, 14.3 feet; over Frying Pan, 11 feet; over Pot Rock, 20 feet; over Heel Tap, 12.1 feet; over reef at the North Brothers, 16 feet.

Hallet's Point from the shore at Astoria projected under water 325 feet to the contour line of 26 feet at mean low water, and embraced an area of about 3 acres. The Middle Reef, with an area of about 9 acres, lay in the middle of the channels at Hell Gate, having a small backbone projecting above high water, and caught vessels swept upon it by the ebb currents, which passed directly over the rock. Hallet's Point and the Middle Reef may be said to have been alternate in mischievous functions; vessels which escaped one ran a great risk of falling upon the other.

What added considerably to the danger from these reefs was the bend at right angles of the river at the spot.

The originally adopted project for the improvement was the least extensive of three projects discussed by the engineer in charge. That one now being carried out was judged by the authorities in 1867 to be too expensive and costly. The project first adopted was the removal of Pot Rock, Frying Pan, Way's Reef, Shelldrake, the rock off Negro Point, the rocks near Woolsey's bath-house, Blackwell's Rock, portions of Hallet's Point, and of Scaly Rock. Sea-walls were designed for the Middle Reef, Hog's Back, the Bread and Cheese, and a beacon for Rylander's Reef.

The project most favored by the engineer in charge. which included likewise the total removal of Hallet's Point and of the Middle Reef, has, as time passed, received the approval of the authorities.

The project first intended solely for Hell Gate has also been modified by incorporating with it rocky obstructions in the East River, Diamond Reef, Coenties Reef, and a reef near the North Brothers.

The amount expended thereon to the close of the fiscal year ending June 30, 1882, was $2,930,418.98.

The condition of the improvement was the removal of Diamond Reef, Coenties Reef, and Way's Reef, and Shelldrake, to a depth of 26 feet at mean low water; the breaking up of Heel Tap Rock, the tunneling an explosion of Hallet's Point, and the removal of the *débris* to the depth of 26 feet at mean low water; the tunneling of the Middle Reef (Flood Rock) to the extent of 19,975.87 linear feet, and the removal therefrom of 56,145.3 cubic yards of stone measured in place; the removal of the reef off the North Brothers Island to the depth of 26 feet at mean low water.

The amount expended during the year ending June 30, 1883, was $206,526.30.

Some loose rock has been removed from Hallet's Point Reef; drilling and blasting on Pot Rock and Frying Pan reefs; and the tunnels of the Middle Reef (Flood Rock) were driven 204.03 linear feet, and 14,202.6 cubic yards of stone measured in place removed, and nearly all the roof holes for the final blast had been drilled. During the year ending June 30, 1884, the available balance will be sufficient only for the care and preservation of the work and running the pumps to keep the excavation on Flood Rock from filling with water.

The estimated amount required for the entire and permanent completion of the work of improvement in accordance with the approved and adopted project is $1,963,029.67.

The officer in charge estimates that $500,000 can be profitably expended in the fiscal year ending June 30, 1885. Of this amount $360,000 is the estimated cost of blowing up the reef; $60,000 for extending certain galleries to embrace the whole area to be removed, and the balance, $80,000, for the removal of other reefs in the East River and Hell

Gate. It is useless, of course, to appropriate any sum less than the cost of explosion.

July 1, 1882, amount available		$25,623 35
Received from sales of fuel		48 00
Amount appropriated by act passed August 2, 1882		200,000 00
		225,671 35
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$186,526 30	
July 1, 1883, outstanding liabilities	3,324 63	
		189,850 93
July 1, 1883, amount available		35,820 42
Amount (estimated) required for completion of existing project		1,963,029 67
Amount that can be profitably expended in fiscal year ending June 30, 1885.		500,000 00

(See Appendix E 3.)

4. *Buttermilk Channel, New York.*—The channel in its original condition was obstructed by a large shoal, with a minimum depth of 9½ feet at mean low water, which lay in the direct track of navigation, too near the wharves of Brooklyn for the safe passage or maneuver of large vessels.

The originally adopted project for the improvement was the removal of a sufficient portion of this shoal to the depth of 26 feet at mean low water, and thereby to increase the depth and width of the channel.

The amount expended to the close of the fiscal year ending June 30, 1882, was $62,807.29.

The removal of an increased portion of the shoal was received with a great deal of satisfaction by the shipping interests of New York and Brooklyn, as it greatly facilitated the movements of large vessels coming to this port.

The amount expended during the fiscal year ending June 30, 1883, was $56,355.57, and as the removal of the shoal continues, the benefit to commerce and navigation is proportionally increased.

The available balance, $60,837.14, will be expended in continuing the dredging during the year ending June 30, 1884.

The estimated amount required for the entire and permanent completion of the work in accordance with the revised estimate submitted in my report for the year ending June 30, 1881, is $30,000.

July 1, 1882, amount available		$49.272 71
Amount appropriated by act passed August 2, 1882		60,000 00
		109,272 71
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$48,435 57	
July 1, 1883, outstanding liabilities	7,665 00	
		56,100 57
July 1, 1883, amount available		53,172 14
Amount (estimated) required for completion of existing project		30,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		30,000 00

(See Appendix E 4.)

5. *Harlem River, New York.*—The survey of this work was directed by the act approved June 23, 1874, and on February 18, 1875, a project and estimate were reported for the improvement of the river from Randall's Island to the Hudson River.

The Commissioners appointed by the Supreme Court of the State to secure the right of way free of cost to the United States for the pro-

posed cut or canal to connect the Harlem and Hudson rivers have made their report to the court, where the matter now rests.

The lines of the improvement are given in the annual report for the year ending June 30, 1882.

This work is in the collection district of New York. Nearest port of entry, New York City. Amount of revenue collected during the fiscal year ending June 30, 1883, $147,901,488.93. Amount of commerce to be benefited by this work will be very large.

ORIGINAL ESTIMATE.

For 15-foot channel	$2,100,000

AMOUNTS APPROPRIATED.

By act approved June 18, 1878	300,000
By act approved March 3, 1879	100,000
	400,000
July 1, 1882, amount available	400,000
July 1, 1883, amount available	400,000
Amount (estimated) required for completion of existing project	1,700,000

(See Appendix E 5.)

6. *Gowanus Bay, New York.*—The original condition of the channel was inadequate for the navigation of vessels employed in the commerce of this district, the depth of water varying from 6.9 feet to 12.3 feet at mean low water.

The originally adopted plan was to dredge a channel from the 18-foot contour outside the bay to the draw-bridge at Hamilton avenue; the estimated cost was $182,850. It has been recommended by the officer in charge to dredge the existing channel from Hamilton avenue to the southwest corner of Erie Basin, and thence to divide it into two branches, one to the north and one to the south. The cost of this revised project will be $192,564.90.

The amount expended at the close of the year ending June 30, 1882, was $23,834.43, and a channel dredged 4,374 feet long, 100 feet wide, and 18 feet deep.

The amount expended during the year ending June 30, 1883, was $16,289.48, and a channel dredged 1,826 feet long, 100 feet wide, and 18 feet deep at mean low water.

During the fiscal year ending June 30, 1884, it is proposed to devote the available balance, $19,875.69, to enlarging the channel at the south branch of the improvement, and the channel from Erie Basin towards Hamilton Avenue Bridge.

The estimated amount required for the entire and permanent completion of the improvement, in accordance with the approved and adopted project is $123,000, and for the revised project, $152,564.90.

July 1, 1882, amount available	$9,970 03
Amount appropriated by act passed August 2, 1882	20,000 00
	29,970 03
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	10,094 34
July 1, 1883, amount available	19,875 69
Amount (estimated) required for completion of existing project	122,850 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	30,000 00

(See Appendix E 6.)

7. *Echo Harbor, New Rochelle, New York.*—The original condition of navigation showed rocky obstructions, Start Rock and Sheepshead

Rock, the former exposed in part at low water and the latter with a least depth over it at mean low water of 1 foot.

The originally adopted project was the removal of these rocks, the former to 6 feet at mean low water and the latter to 9 feet. A change of project was made by increasing the depth of removal of Start Rock to 7 feet at mean low water.

The amount expended to June 30, 1882, was $10,508.37, and the condition of the improvement was the removal of Start Rock to the depth of 7 feet at mean low water.

The amount expended during the fiscal year ending June 30, 1883, was $8,126.26, and has resulted in the removal of a portion of Sheepshead Reef.

The estimated amount for the entire and permanent completion of the work of improvement in accordance with the approved and adopted project is $16,955.38.

July 1, 1882, amount available		$491 63
Amount appropriated by act passed August 2, 1882		3,000 00
		3,491 63
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		125 26
July 1, 1883, amount available		3,366 37
Amount (estimated) required for completion of existing project		16,955 38
Amount that can be profitably expended in fiscal year ending June 30, 1885		17,000 00

(See Appendix E 7.)

8. *Harbor at New Rochelle, New York.*—The original condition of the channel was that it was narrow and interspersed with sunken reefs of rocks which made it dangerous for navigation, and in the channel proposed to be excavated by dredging, the depth varied from 0 to 8 feet at mean low water.

The originally adopted project was to remove rocky obstructions and dredge an inner channel between Hunter's and Flat islands; the estimated cost was $40,825, and this project has not been modified.

The expenditures up to June 30, 1882, were $9,275.43, and a channel had been dug around Glen Island 100 feet wide, and 6 feet deep at mean low water.

The expenditures during the year ending June 30, 1883, were $307.97, and were principally for surveys.

Authority having been given to undertake the removal of "Corning Rock" with the steam drilling scow, it is proposed early in July to commence operations on this rock.

The estimated sum required for the entire and permanent completion of the work of improvement, in accordance with the approved and adopted project, is $5,825.

July 1, 1882, amount available		$10,493 42
Amount appropriated by act passed August 2, 1882		15,000 00
		25,493 42
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$307 97	
July 1, 1883, outstanding liabilities	9,000 00	
		9,307 97
July 1, 1883, amount available		16,185 45
Amount (estimated) required for completion of existing project		5,825 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		6,000 00

(See Appendix E 8.)

9. *Port Chester Harbor, New York.*—In its original condition the channel was obstructed by Sunken and Salt rocks, the former with a depth over it of 5.7 feet at mean low water, the latter slightly projecting above the level of mean low water.

The amount expended to the close of the fiscal year 1882 was $10,050, and the condition of the improvement was theremoval of Salt Rock to a depth of 9 feet at mean low water.

The estimated amount required for the completion of the improvement of the harbor according to the adopted and approved plan is $69,632.

The originally adopted project for this improvement comprised the removal of rock and the construction of a breakwater. The rock having been removed the amount that remains for the completion of the project is the estimated cost of the breakwater. The necessity for this being deemed doubtful, no further appropriation is asked.

July 1, 1882, amount available	$1,950 00
Amount appropriated by act passed August 2, 1882	15,000 00
	16,950 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	25 00
July 1, 1883, amount available	16,925 00
Amount (estimated) required for completion of existing project	16,632 00

(See Appendix E 9.)

10. *Raritan River, New Jersey.*—The original condition of the navigation was an intricate channel at the Stakes of 7 feet at mean low water, and of 6.1 feet on the Middle Ground, and of 7 to 8 feet at mean low water upon the other shoals as far up as New Brunswick.

The originally adopted project was to dike and dredge at the Stakes and Middle Ground and to remove other shoals up to New Brunswick, so as to make a channel 200 feet wide and at least 10 feet deep at mean low water, and no modification has been made.

The amount expended to the close of the fiscal year ending June 30, 1882, was $353,196.01.

The condition of the improvement at that time was the completion of the dikes at the Stakes and Middle Ground, a channel at the Stakes everywhere over 12 feet deep at mean low water except for a short distance, where it has been dredged to but 9 feet at mean low water; dredging has also been done at the Middle Ground, giving a channel 5,300 feet long, 12 feet deep at mean low water, and of an average width of 130 feet; and a channel has been completed through the rocky shoal at Whitehead's Sand Dock, by drilling and blasting, 1,000 feet long, 75 feet wide, and 12 feet deep at mean low water.

There has been expended during the fiscal year ending June 30, 1883, $36,902.64, including outstanding liabilities.

A channel has been completed through the rocky shoal at Whitehead's Sand Dock 1,000 feet long, 134 feet wide, and 12 feet deep at mean low water, and a cut has been dredged through the South channel 2,520 feet long, 100 feet wide, and 5½ feet deep at mean low water.

The balance, $15,979.47, will be expended during the year ending June 30, 1884, in blasting and removing the rocks at Whitehead's Sand Dock and doing some little dredging in the South channel.

The estimated amount required for the entire and permanent completion of the work of improvement in accordance with the approved and adopted project is $1,683,662.

July 1, 1882, amount available		$27,792 11
Received from sales of coal		90 00
Amount appropriated by act passed August 2, 1882		25,000 00
		52,882 11
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$34,923 90	
July 1, 1883, outstanding liabilities	1,978 74	
		36,902 64
July 1, 1883, amount available		15,979 47
Amount (estimated) required for completion of existing project		1,683,662 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		60,000 00

(See Appendix E 10.)

11. *South River, New Jersey.*—The original condition of the navigable channel is:

A false direction of the canal mouth, a depth there at mean low water of 3½ feet; thence up to Little Washington, depths varying from 3.1 to 11.6 feet at mean low water; thence to Bissett's Brick-yard, depths varying from 2.8 to 10.1 feet at mean low water; and thence to Old Bridge, depths varying from 2.1 to 12.5 feet at mean low water. There are also several sharp bends above Little Washington where it will be expedient to straighten the course occasionally by cuts.

The originally adopted project, which has not been modified, was: To change the outlet of the canal; to close the natural course of the river below Tetit's; to dike and to dredge in order to obtain 8 feet at mean low water up to Little Washington; thence to straighten the course, dike and dredge up to Bissett's Brick-yard in order to obtain 6 feet at mean low water; and, finally, to straighten the course, dike and dredge to Old Bridge in order to obtain 4 feet at mean low water.

The amount expended to the close of the year ending June 30, 1882, was $738.63, without change in the condition of the river.

The amount expended during the year ending June 30, 1883, was $23,338.57, with some advantage to commerce near the outlet to the canal, the work not being sufficiently advanced as yet to produce the desired results. The balance, $3,920.74, will be applied to continuing the filling of Dikes A, B, and C with stone.

The estimated amount for the entire and permanent completion of the work of improvement, in accordance with the approved and accepted project, is $138,695.

July 1, 1882, amount available		$45,261 37
Received from sales of coal		30 06
Amount appropriated by act passed August 2, 1882		10,000 00
		55,291 43
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$23,338 57	
July 1, 1883, outstanding liabilities	28,032 12	
		51,370 69
July 1, 1883, amount available		3,920 74
Amount (estimated) required for completion of existing project		138,695 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		23,000 00

(See Appendix E 11.)

12. *Removal of sunken vessel obstructing or endangering navigation.*—The attention of the Secretary of War having been called to the existence of the wreck of a craft of 250 tons lying near the east shore of Hudson River, near Sing Sing, in a position to endanger navigation,

an examination of the wreck was made and its owners duly notified to remove it. This not having been complied with at the expiration of thirty days, under provisions of the river and harbor act of June 14, 1880, a contract, after due advertisement, was made December 21, 1882, for its removal, which was done at the cost of $1,201.15.

(See Appendix E 12.)

IMPROVEMENT OF RIVERS AND HARBORS ON WESTERN LONG ISLAND, IN THE VICINITY OF NEW YORK CITY, AND IN NORTHERN NEW JERSEY.

Officer in charge, Maj. G. L. Gillespie, Corps of Engineers.

1. *Flushing Bay, New York.*—The original condition of the navigable channel was a depth at the shoalest part along the line leading to Flushing of 3.9 feet at mean low water, and it was not therefore available for commerce.

The originally adopted project of 1879 for the improvement was the formation of a tidal basin by means of dikes, which by its filling and emptying through one channel would keep up a depth of 6 feet at mean low water, and even more after once having been dredged. No modification has been made in the project.

The amount expended up to the close of the fiscal year ending June 30, 1882, was $42,744.29. At that time about 3,000 feet of diking had been constructed, a channel 60 feet wide and nearly 6 feet deep at mean low water carried to Flushing, and a channel 100 feet wide and 6 feet deep carried to the Newtown side of the bay.

The improved channel has been extended outwards 1,900 feet to the 6-foot curve of the exterior bay, for a width of 80 feet with 6 feet at mean low water, and a branch channel with equal width and depth has been opened from the Flushing channel at head of dike to Hill's dock on west side, a distance of 1,500 feet. The amount dredged was 31,959 cubic yards.

The appropriation of $40,000 asked for is to extend the dike 2,700 feet outwards and to widen the channel throughout to a full width of 100 feet. The benefit to be expected from the improvement is a better maintenance of the channel.

July 1, 1882, amount available		$2,255 71
Amount appropriated by act passed August 2, 1882		5,000 00
		7,255 71
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		7,247 08
July 1, 1883, amount available		8 63
Amount (estimated) required for completion of existing project		123,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		40,000 00

(See Appendix F 1.)

2. *Newtown Creek, New York.*—The original condition of the channel gave a depth of 12½ to 18 feet at mean low water, which was insufficient for the large class of vessels frequenting the creek. The width was 240 feet.

The originally adopted project of 1880 for the improvement was to dredge a channel about 200 feet wide, and from 18 to 21 feet in depth, and no change has been made in the project.

The amount expended up to the close of the fiscal year ending June 30, 1882, was $8,852.89. At that date the improved channel below Ver-

non Avenue Bridge had a width of 60 feet, with 15½ to 17 feet depth at mean low water.

The channel from Vernon Avenue Bridge to the entrance at East River, a distance of 2,300 feet approximately, has been deepened to a depth of 18 feet at mean low water for a width varying from 80 feet to 150 feet.

Fifty-two thousand and five cubic yards of material were removed, including some large bowlders found near the bridge.

The local engineer recommends an appropriation of $75,000 for continuing the improvement, $21,000 to be applied in completing the original project for the improvement at the entrance, and the residue to be applied towards the opening of a channel 100 feet wide, giving 10 feet at mean low water, extending from the Vernon Avenue Bridge up stream to the head of navigation at Metropolitan Avenue Bridge.

The benefits to be expected are those accompanying the better maintenance of the lower reach of the creek, and the extension of its navigable length, whereby a greater number of industrial manufactories are reached by large vessels.

July 1, 1882, amount available	$1,147 11
Amount appropriated by act passed August 2, 1882	15,000 00
	16,147 11
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	15,200 24
July 1, 1883, amount available	946 87
Amount (estimated) required for completion of existing project	75,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	75,000 00

(See Appendix F 2.)

3. *East Chester Creek, New York.*—The original condition of navigation was, between Town Dock and Lockwood's, a draught of less than 7 feet at high water through an intricate, crooked, and narrow channel, a draught in the channel south of Goose Island rather more than 7 feet at high water, and a dangerous reef of bowlders, &c., in close proximity to the course of vessels in passing the draw at Pelham Bridge.

The originally adopted project (1872) was for the making of a channel of 9 or 10 feet draught at high water from Town Dock to a point 3,000 feet above Lockwood's, which included the construction not yet undertaken of a tidal basin above Lockwood's. To this have been since added the dredging of the channel west of Goose Island and the removal of the reef of bowlders, gravel, &c., just below Pelham Bridge.

The amount expended up to the close of the fiscal year ending June 30, 1882, was $46,898.20. At that date the improved channel had an approximate depth of 9 feet at mean high water as far as Lockwood's, with one shoal below Town Dock.

The amount available for the improvement, $7,081.80, will be applied in extending the 9-foot channel, mean high water, from Pell Point up stream as far as Town Dock by dredging a channel 1,500 feet long and 50 feet wide.

The local engineer recommends an appropriation of $30,000 for dredging 25,000 cubic yards of material and for constructing 2,500 linear feet of sheet pile diking below Town Dock for the purpose of maintaining the channel which it is proposed to improve in the lower part of the river. Amount necessary to be appropriated for the entire completion of original project, $82,500.

July 1, 1882, amount available	$7,101 80
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	20 00
July 1, 1883, amount available	7,081 80
Amount (estimated) required for completion of existing project	82,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	30,000 00

(See Appendix F 3.)

4. *Canarsie Bay, New York.*—The object of this improvement is to connect Canarsie Landing with the deep water of Jamaica Bay by a channel having a depth of 6 feet at mean low water, the original depth being only 4½ feet across the flats. The original project adopted in 1879 contemplated the construction of an interior tidal basin by means of timber dikes, and no important amendments, alterations, or additions thereto have been made.

The amount expended to close of fiscal year ending June 30, 1882, was $9,779.29. The condition of the incomplete improvement at that time was the construction of a dike about 1,000 feet long.

The channel is now, with 6 feet at mean low water, opened from Jamaica Bay to the Canarsie Landing; its width at the dike is 50 feet, enlarged to 75 feet near the wharf. Vessels can now lie at any point of the wharf at all stages of the tide.

The appropriation of $20,000 asked for will be applied in the construction of the sheet-pile dike on the south side embodied in the original project. The benefit to be expected is the better maintenance of the improved channel.

July 1, 1882, amount available	$5,220 71
Amount appropriated by act passed August 2, 1882	3,000 00
	8,220 71
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	8,220 71
Amount (estimated) required for completion of existing project	70,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	20,000 00

(See Appendix F 4.)

5. *Sheepshead Bay, New York.*—The original condition of the navigable channel was, for the entrance, a depth of little over 2 feet at mean low water, and for the interior channel not less than 4 feet, except at two narrow bulkheads across said channel.

The originally adopted project (1879), with a proviso, however, not to be commenced should the movement of Rockaway Inlet be likely to interfere, was to deepen the entrance by means of converging jetties, and to improve the interior channel by longitudinal dikes, so placed as in some instances to form tidal reservoirs for the scour of the channel.

The project was revised in 1881, and provides for excavating a channel at the outlet to connect the bay with Dead Horse Inlet and to dredge the interior channel.

The amount expended up to the close of the fiscal year ending June 30, 1882, was $643.82. At that date no work of improvement had been commenced.

The amount expended during the fiscal year ending June 30, 1883, was $72.08. No operations have been carried on during the year.

A contract has been made for excavating 20,000 cubic yards of material, but work will not be commenced until it can be determined how the available funds can be best applied.

It is probable that the interior channel will be dredged first. The local engineer recommends an appropriation of $35,000 for excavating the channel to connect with Dead Horse Inlet, and for revetting its slopes. The benefit to be expected is the better maintenance of the improved channel.

July 1, 1882, amount available	$7,356	18
Amount appropriated by act passed August 2, 1882	3,000	00
	10,356	18
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	72	08
July 1, 1883, amount available	10,284	10
Amount (estimated) required for completion of existing project	89,000	00
Amount that can be profitably expended in fiscal year ending June 30, 1885	35,000	00

(See Appendix F 5.)

6. *Sumpawanus Inlet, New York.*—The original project, which was adopted in 1880, provided for the dredging of a channel from 150 to 100 feet in width and 5 feet deep at mean low water, has not been modified.

Amount expended up to close of fiscal year ending June 30, 1882, was $32. At that time no work of improvement had been commenced.

There was expended in dredging during the fiscal year ending June 30, 1883, $6,861.07.

A channel 1,000 feet long and 75 feet wide, giving 5 feet at mean low water, has been opened from the 5-foot curve, mean low water, of South Bay, to and inside of railroad wharf at the entrance to the inlet, and cuts around the wharf have been made for the convenience of vessels using the inlet as a refuge during easterly gales.

The original amount estimated to complete the project was $23,115, but owing to increased cost of dredging under small appropriations the estimate should be increased to $40,000.

An appropriation of $15,000 is asked for extending the improved channel in accordance with the original project, so as to enlarge the area of protection for vessels taking refuge in the inlet.

The estimated amount required to complete the project, based on increased cost of dredging, is $33,000.

July 1, 1882, amount available	$4,968	00
Amount appropriated by act passed August 2, 1882	2,000	00
	6,968	00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	6,861	07
July 1, 1883, amount available	106	93
Amount (estimated) required for completion of existing project	33,000	00
Amount that can be profitably expended in fiscal year ending June 30, 1885	15,000	00

(See Appendix F 6.)

7. *Cheesequakes Creek, New Jersey.*—The original condition of the channel over the bar or shoal at the mouth gives a depth of 1 foot at mean low water for about three-fourths of the length to be improved, and for the remaining portion a depth from 4 feet to 1½ feet at low water. The course of the creek is very crooked and requires to be straightened.

The originally adopted project (1879) for the improvement was to change the outlet into a direction at right angles to the beach; to sustain this direction by parallel jetties of stone, and to straighten

the course of the creek and increase the depth in the upper portions thereof.

The amount expended up to the close of the fiscal year ending June 30, 1882, was $707.89. At that date no work of improvement had been commenced.

The amount expended during the fiscal year ending June 30, 1883, was $27,826.70, including outstanding liabilities, and was applied in the construction of the two stone jetties at the entrance, each 1,000 feet long, extending to the 2½-foot curve of the bay, mean low water, and in opening a channel through the beach 450 feet long, 65 feet wide, with 5 feet water at mean low water. The contract is still in progress. The balance $11,465.41 unexpended will be applied in continuing the dredging and in closing the original outlet by the construction of a sheet-pile revetment across the creek above the county road bridge.

The freeholders of Middlesex County will provide a bridge, with an adequate draw-opening across the new channel. The amount required for the entire and permanent completion of the project according to the original estimate is $35,279. The local engineer reports that that estimate should be increased. The appropriation of $20,000 asked for will be applied in extending the jetties each 500 feet to the 5-foot curve, and in carrying the improved channel, by dredging, to the same curve. The benefit to be expected is the extension of the channel entrance and its better maintenance.

July 1, 1882, amount available		$24,292 11
Amount appropriated by act passed August 2, 1882		15,000 00
		39,292 11
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$21,248 24	
July 1, 1883, outstanding liabilities	6,578 46	
		27,826 70
July, 1, 1883, amount available		11,465 41
Amount (estimated) required for completion of existing project		35,279 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		20,000 00

(See Appendix F 7.)

8. *Passaic River above Newark, New Jersey.*—The present project was adopted in 1872, and provides for the removal of rock and other obstructions between Newark and the head of navigation, so as to afford a sufficient channel 6 feet deep at mean low water. The total amount expended to June 30, 1882, was $111,547.38, and has resulted in securing a 6-foot channel, of moderate width at mean low water, from the Midland Bridge to Passaic.

No work was done during the year. The appropriation of $7,000, act August 2, 1882, will be applied in cutting a channel 100 feet wide and 7½ feet at low water through the shoals a short distance above the city of Newark. Sealed proposals invited by public advertisement for the execution of this work, will be opened on July 27, 1883.

The appropriation of $3,000 asked for is to be applied to the completion of the dredging required by the existing project, so that boats may run between Newark and Passaic at low stage of water without detention.

The commissioners provided for by the State legislative act of 1882, for considering the question of placing a dam across the river near Belleville to protect the water supply for Jersey City, have taken no action as yet.

July 1, 1882, amount available	$2,452 62
Amount appropriated by act passed August 2, 1882	7,000 00
	9,452 62
July 1, 1883, outstanding liabilities	53 50
July 1, 1883, amount available	9,399 12
Amount (estimated) required for completion of existing project	3,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	3,000 00

(See Appendix F 8.)

9. *Passaic River, from Pennsylvania Railroad Bridge to its mouth, New Jersey.*—The project for this improvement was adopted in 1880, and provides for the formation and maintenance of a channel 200 feet wide and 10 feet deep at mean low water, from Pennsylvania Railroad Bridge at Centre street, Newark, to Newark Bay.

The amount expended up to the close of the fiscal year ending June 30, 1882, was $70,070.18. At that date a dike 2,003¼ feet long had been built at the entrance, and a channel dredged on the east side, 200 feet wide, with a depth of 10 feet at mean low water.

The unexpended balance June 30, 1882, of appropriation March 3, 1881, and the appropriation of August 2, 1882, so far as expended, were applied in the excavation of 131,140 cubic yards of material from the dike at the entrance upstream past the Toll Bridge. The improved channel has a width of 400 feet at the entrance; thence is 200 feet to New York and Newark Railroad Bridge, and thence 100 feet wide to a point about 3,300 feet above the Toll Bridge. The appropriation of $85,000 asked for will be applied in widening the improved channel throughout to the projected width of 200 feet, and in constructing 5,000 feet approximately of diking from below the Toll Bridge to the Zinc Works. This improvement is needed to give more channel room to sailing vessels, and to better maintain the improved channel near the entrance.

July 1, 1882, amount available		$9,929 82
Amount appropriated by act passed August 2, 1882		43,000 00
		52,929 82
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities, July 1, 1882	$21,068 87	
July 1, 1883, outstanding liabilities	3,035 65	
		24,104 52
July 1, 1883, amount available		28,825 30
Amount (estimated) required for completion of existing project		85,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		85,000 00

(See Appendix F 9.)

10. *Channel between Staten Island and New Jersey.*—The project for this improvement (1880) provides for the excavation of a channel 400 feet wide from the east side of Shooter's Island to the deep water of Arthur's Kill, the central portion of which for a width of 200 feet shall be 13 feet deep at mean low water, and the residue 12 feet.

The amount expended up to the close of the fiscal year ending June 30, 1882, was $50,171.35. At that time the projected channel, 200 feet wide and 13 feet deep, had been extended from Shooter's Island to Arthur's Kill.

During the year the channel has been dredged to the extent of the approved project. The amount removed was 158,637 cubic yards.

It is proposed to apply the appropriation of $25,000 asked for the fiscal

year ending June 30, 1885, in deepening the channel throughout its width of 400 feet to a uniform depth of 13 feet mean low water and in removing any deposits occurring at any point in the channel during the interval of suspension of work. This improvement is necessary to give more room for sailing-vessels of large class which go to Elizabethport.

The local engineer recommends that the construction of the dikes forming part of the original project be deferred until a more pressing necessity arises for their use.

July 1, 1882, amount available	$3,828 65
Amount appropriated by act passed August 2, 1882	40,000 00
	43,828 65
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	42,033 27
July 1, 1883, amount available	1,795 38
Amount (estimated) required for completion of existing project	93,698 63
Amount that can be profitably expended in fiscal year ending June 30, 1885	25,000 00

(See Appendix F 10.)

11. *Shrewsbury River, New Jersey.*—The present project was adopted in 1879, and provides for the formation of a channel 6 feet in depth at mean low water, from the entrance of the Shrewsbury River to Upper Rocky Point on the North Branch, and to Jumping Point on the South Branch.

The amount expended up to close of fiscal year ending June 30, 1882, was $144,992.99. At that time the channel for a width of 100 feet, and a depth of 6 feet was carried to Oceanic Wharf, in the North Branch, and to Pleasure Bay, in the South Branch. At the entrance a dike was built 4,021 feet long, and a channel 50 feet wide and 6 feet deep was opened over the bar.

During the fiscal year ending June 30, 1883, $36,551.95, including outstanding liabilities, were expended. The amount available for the improvement during the current fiscal year was $49,507.01, and was divided among the improvements in progress, and in contemplation in the main river and its two branches. A channel 75 feet wide and 6 feet deep, mean low water, has been opened at the entrance, and a cut 50 feet wide with same depth was made in North Branch abreast the opening between the dikes on the south side of channel. A channel 150 feet wide with 6 feet depth mean low water was also opened in South Branch from Seabright to Pleasure Bay, together with a cut 50 feet wide and 7 feet deep through the rocky ledge just above the Seabright Bridge.

Under the river and harbor act of August 2, 1882, appropriating $30,000, a contract was made for dredging 67,000 cubic yards of material, at 35¾ cents per cubic yard, and for building a sheet-pile dike on the east side of entrance to Pleasure Bay, 523 feet long, at $5.50 per linear foot. The dike was completed in November. The dredging is now in progress. A channel has been opened below Highland's Bridge in the main channel 100 feet wide and 800 feet long, and a cut 100 feet wide and 2,150 feet long in the North Branch. The total amount removed to the close of the fiscal year was 71,315 cubic yards.

The appropriation of $ 0,000 asked for will be applied in deepening the North Branch by dredging, and in building a pile dike 1,400 feet long to complete the diking projected for the south side of the North Branch channel, in dredging the South Branch from junction with North Branch to Seabright, in deepening and maintaining the improved channel below Highland's Bridge, and deepening, widening, and maintaining

the improved channel at the entrance at and beyond the dike below Crane Point.

The benefits to be expected are the improving of the navigation of the main stem and two branches of the river, and the better maintenance of the channels already improved.

July 1, 1882, amount available		$19,507 01
Amount appropriated by act passed August 2, 1882		30,000 00
		49,507 01
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$32,495 17	
July 1, 1883, outstanding liabilities	4,056 78	
		36,551 95
July 1, 1883, amount available		12,955 06
Amount (estimated) required for completion of existing project		50,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		50,000 00

(See Appendix F 11.)

12. *Rahway River, New Jersey.*—The present project was adopted in 1878, and contemplates a channel 8 feet deep at high water, and varying in width from 125 to 100 feet from Bricktown up to Main Street Bridge, in the town of Rahway.

The amount expended up to the close of the fiscal year ending June 30, 1882, was $25,443.82. At that time the improved channel 50 feet wide and 7 feet deep, at mean high water, had reached a point 200 feet below Milton Avenue Bridge in suburbs of Rahway, N. J.

During the fiscal year 4,165 cubic yards were removed from the river which resulted in the extension of the channel from 200 feet below Milton Avenue Bridge up-stream through the east draw to a point 75 feet above Chamberlain's Dock, and a branch channel was carried as far as the west draw opening of the same bridge.

The appropriation of August 2, 1882, was let to contract to extend the west channel.

At the close of the fiscal year the northern extremity of the west channel was 450 feet above the bridge. The appropriation of $10,000 asked for will be applied towards continuing the existing plan of improvement. The commerce of the river will be benefited by widening the channel to the full width of the original project.

July 1, 1882, amount available		$4,556 18
Amount appropriated by act passed August 2, 1882		7,000 00
		11,556 18
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$4,766 86	
July 1, 1883, outstanding liabilities	3,254 30	
		8,021 16
July 1, 1883, amount available		3,535 02
Amount (estimated) required for completion of existing project		29,250 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		10,000 00

(See Appendix F 12.)

13. *Elizabeth River, New Jersey.*—The improvement of this river was commenced in 1879, in accordance with the authorized project which contemplates the formation of a channel 60 feet wide and 7 feet deep at mean high water, from the mouth of the river to the head of navigation at Stone Bridge, at the Broad street crossing.

The amount expended up to the close of the fiscal year ending June

30, 1882, was $19,000. At that time the improved channel, with 7 feet at mean high water, had reached the iron draw-bridge at South street in the town of Elizabeth.

The appropriation, August 2, 1882, of $8,000, was publicly advertised and the contract for continuing the improvement by dredging above South Street Bridge, was awarded at 64 cents per cubic yard. Operations were commenced May 26, and are still in progress. The amount removed to close of fiscal year was 4,142 cubic yards. The improved channel, 25 to 50 feet wide, with 7 feet mean high water, has been carried 1,600 feet above the South Street Bridge.

The appropriation of $16,200 asked for is to complete the existing project, so that vessels may have a wider channel in ascending river.

Amount appropriated by act passed August 2, 1882		$8,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$204 54	
July 1, 1883, outstanding liabilities	2,348 51	
		2,553 05
July 1, 1883, amount available		5,446 95
Amount (estimated) required for completion of existing project		16,160 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		16,200 00

(See Appendix F 13.)

14. *Woodbridge Creek, New Jersey.*—The present project was adopted in 1878, and contemplates the formation of a channel 80 feet wide and 12 feet deep at mean high water, from the entrance to Town Dock.

The appropriation of $5,000, act August 2, 1882, was applied in extending the improvement from Anderson's Wharf to Valentine's Wharf, a distance of 3,200 feet along the river. The improved channel is now 50 feet wide to Clay Docks, and thence to Valentine's Dock, 25 feet wide.

The amount expended up to the close of the fiscal year ending June 30, 1882, was $14,000. At that date the improved channel had been widened to 75 feet at the shoal above Boynton's Dock, and carried thence 50 feet wide, with 12 feet at mean high water, to Anderson's Dock.

The appropriation of $4,000 asked for will be applied in completing existing plans, for the better accommodation and convenience of vessels.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	5,000 00
Amount (estimated) required for completion of existing project	4,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	4,000 00

(See Appendix F 14.)

15. *Manasquan River, New Jersey.*—The present project was adopted in 1879, and has for its object the opening of a direct channel-way across the beach and protecting the same from the flow of the tidal currents between the river and the ocean so as to obtain and maintain a suitable depth for the passage of vessels similar to those now employed on the basins of the river above its mouth and for coasters of light draught, the original depth on the outer bar varying from 1 to 3 feet at mean low water.

The amount expended up to the close of the fiscal year ending June 30, 1882, was $30,481.08. At that date the protecting jetty on the north side had been completed for a length of 1,515 feet, and the channel across the outer bar made in consequence more direct, with a slight increase of depth.

During the fiscal year a portion of the projected south jetty, 475 feet in length, was built.

The channel between the jetties is 200 feet wide and the water there is 6 feet approximately at mean low water; the least water on the outside bar is 3 to 3½ feet, mean low water. The local engineer reports the improvement in an encouraging condition and recommends an appropriation of $25,000 for extending both jetties, for making and maintaining a better channel at the entrance.

July 1, 1882, amount available		$1,518 92
Amount appropriated by act passed August 2, 1882		7,000 00
		8,518 92
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$2,393 38	
July 1, 1883, outstanding liabilities	6,124 01	
		8,517 39
July 1, 1883, amount available		1 53
Amount (estimated) required for completion of existing project		33,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		25,000 00

(See Appendix F 15.)

16. *Raritan Bay, New Jersey.*—The present project was adopted in 1880, the object being to afford a channel 300 feet wide and 21 feet deep at mean low water, to connect the deep water to the west of Seguine Point with the deep waters at the Amboys.

The amount expended up to the close of the fiscal year ending June 30, 1882, was $49,792.47. At that date a channel had been opened across the shoal, 8,000 feet long, 105 feet wide, and 21 feet deep at mean low water.

Operations for widening the channel improvement under act of March 3, 1881, were resumed in May, 1883, under the appropriation of August 2, 1882, and are still in progress; $13,192.34 were expended during the fiscal year ending June 30, 1883 (including outstanding liabilities). The channel has been widened 35 feet for a distance of 8,000 feet by the removal of 56,200 cubic yards of material.

The local engineer recommends an appropriation of $60,000 for completing the improvement projected for the Seguine Channel, and for widening and deepening the narrow channel off Ward's Point, Staten Island, so that vessels drawing 20 feet may reach the wharves at Perth Amboy without detention at all stages of the tide.

July 1, 1882, amount available		$207 53
Amount appropriated by act passed August 2, 1882		50,000 00
		50,207 53
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$828 34	
July 1, 1883, outstanding liabilities	12,364 00	
		13,192 34
July 1, 1883, amount available		37,015 19
Amount (estimated) required for completion of existing project		60,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		60,000 00

(See Appendix F 16.)

17. *Mattawan Creek, New Jersey.*—The present project was adopted in 1881, the object being to afford a channel 100 feet wide and 4 feet deep at mean low water, from the mouth to railroad crossing in the town of Mattawan.

The amount expended up to the close of the fiscal year ending June 30,

1882, was $14,844.91. At that date the improved channel, 50 feet wide, with 4 feet depth at mean low water, had been extended from the entrance to the Brick Factory near the Mattawan Dock, in Mattawan.

The amount expended during the fiscal year ending June 30, 1883 ($6,155.09), has been applied in improving the creek from the Brick Factory to the railroad crossing. The channel is 60 feet wide as high up as a point 600 feet above the Brick Factory; thence to the head of navigation it is only 30 feet wide.

The appropriation of $9,000 asked for is to widen the upper part as the original project provides, so that vessels may have more channelway in reaching the head of navigation.

July 1, 1882, amount available	$155 09
Amount appropriated by act passed August 2, 1882	6,000 00
	6,155 09
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	6,155 09
Amount (estimated) required for completion of existing project	12,120 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	9,000 00

(See Appendix F 17.)

18. *Keyport Harbor, New Jersey.*—The present project was adopted in 1873, and provides for a channel 200 feet wide, 4,700 feet long, and 8 feet deep, mean low water, from Keyport Wharf to the 8-foot curve, mean low water, of Raritan Bay. The appropriation of August 2, 1882, of $30,475 (the first made for this work) was publicly advertised, and the contract for dredging was awarded at 24 cents per cubic yard. During the fiscal year ending June 30, 1883, $803.77 were expended.

Operations commenced June 26, 1883, and are now in progress; 1,863 cubic yards of material have been removed. The local engineer recommends an additional appropriation of $10,000 for removal of new shoals in the channel which the examination of September, 1882, indicates had taken place since the original survey of 1872.

Amount appropriated by act passed August 2, 1882		$30,475 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$356 65	
July 1, 1883, outstanding liabilities	447 12	
		803 77
July 1, 1883, amount available		29,671 23
Amount (estimated) required for completion of existing project		10,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		10,000 00

(See Appendix F 18.)

19. *Removal of sunken vessels obstructing or endangering navigation.*—The contractor for the removal of the wreck of the iron steamer Nankin, lying in the Swash Channel at the entrance to New York Harbor, to which reference is made in last annual report, abandoned the work on June 14, 1883. Proposals were a second time invited by public advertisement, and a contract awarded June 30, for the sum of $27,000, the time of removal being limited to June 30, 1884.

The act of August 2, 1882, enlarged the powers of the Secretary of War only so far as related to the sale of the vessel *before removal*, and did not effect what was desired in the matter. Further, its result was to compel the Government to accept the *highest* bid for the sale, and the *lowest* bid for removal. Such a procedure is impracticable.

The officer in charge suggests amendments to the act in question which he deems essential.

(See Appendix F 19.)

IMPROVEMENT OF DELAWARE AND SCHUYLKILL RIVERS AND OF NORTH BRANCH OF THE SUSQUEHANNA—OF RIVERS IN NEW JERSEY AND DELAWARE—HARBOR IMPROVEMENTS IN DELAWARE RIVER AND BAY—CONSTRUCTION OF PIER AT LEWES—DELAWARE BREAKWATER.

Officer in charge, Lieut. Col. G. Weitzel, Corps of Engineers, with Lieut. Thomas L. Casey, Corps of Engineers, under his immediate orders.

1. *Delaware River between Trenton, New Jersey, and Bridesburg, Pennsylvania.*—The improvement of the eastern channel of the Delaware River at Bordentown, N. J., has been continued during the past fiscal year with the view of obtaining a clear width of 150 feet. Operations commenced in October, 1882, but were suspended during the winter on account of freshets and ice, and the completion of the contract is therefore delayed and still pending.

A reduction of the height of the dikes built in 1879 across the sloughs at Duck Island and Long Bar was found necessary, as well as the laying of 3-inch planks across the tops to prevent washouts. These repairs were made during the fall of last year.

The portion of the east channel near White Hill requires attention, unfavorable changes having occurred since the improvements of 1878.

The present contract will be completed, and the appropriation of $10,000, of August 2, 1882, exhausted during the fiscal year ending June 30, 1884.

For continuing the improvements in the eastern channel of the river near Bordentown, N. J., and for beginning operations at Kincora Bar, there is required for the fiscal year ending June 30, 1885, the sum of $35,000.

The original survey of this part of the Delaware River was ordered by Congress by the act of July 11, 1870, and was limited to that portion of it between Trenton and Bordentown. It was made in the fall of 1870, and the report submitted December 6, 1870. It developed the fact that in the original condition of this portion of the river there was only a single serious obstruction, situated at Periwig Island, about 3 miles below the Trenton Bridge. This obstruction consisted of a shoal about 800 yards in length, with only 3 feet of water over it at low water.

The original project adopted for the improvement was to excavate a cut through the shoal so as to provide a channel 200 feet wide and 6 feet deep at low water.

To the close of the fiscal year ending June 30, 1876, the sum of $45,000 had been expended on this portion of the river, and none since, because it had become evident that dredging alone would not suffice to maintain a good channel at Periwig Island. The channel, which at the end of the work had been found to be 120 feet wide and 6 feet deep at low water, had diminished in August, 1878, to 75 feet in width, and from 4 to 4½ feet in depth.

Nothing has been expended on this part of the river since the close of the work in 1876, and the results are stated in the previous paragraph.

No further appropriations were made until June 18, 1878, when $10,000 were granted, with the limits extended to White Hill, the next point below Bordentown. The title of the appropriation had been changed by the act of 1878 to improvement of Delaware River between Trenton and White Hill.

On September 16, 1878, a project was submitted and approved for the expenditure of this appropriation in deepening the eastern channel

of the river in front of Bordentown, N. J., to 7 feet. The original condition of the navigable channel at this point was such that only from 4 to 4½ feet could be carried to the mouth of the Delaware and Raritan Canal.

The project of September 16, 1878, above referred to, was an addition to the original project.

The amount expended on this additional project and accessory works to the close of the fiscal year ending June 30, 1882, was $36,000. At that date the channel in the vicinity of Bordentown had a least depth of 7 feet and least width of about 50 feet.

During the fiscal year ending June 30, 1883, the sum of $7,174.44 was expended, and resulted in a further increase and improvement of the improved channel near Bordentown.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $35,000. It is proposed with this sum to continue the widening of the artificial channel near Bordentown and begin the dredging of Kincora Bar.

The advantages and benefits to navigation will be to facilitate the large commerce of the Delaware and Raritan Canal from cr to its entrance to and from Philadelphia and other points, and facilitate the navigation of the river to Trenton.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$6,724 28	
July 1, 1883, outstanding liabilities	450 16	
		7,174 44
July 1, 1883, amount available		2,825 56
Amount (estimated) required for completion of existing project		75,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		35,000 00

(See Appendix G 1.)

2. *Delaware River below Bridesburg, Pennsylvania.*—With the $136,000 appropriated by the act which passed August 2, 1882, the general improvement of the Delaware River was continued at the head of Petty's Island, near Petty's Island, on Mifflin Bar, on Bulkhead Shoals, and the survey of the Delaware River in front of Philadelphia in order to obtain data for future improvements.

Two allotments were made for the river near Petty's Island; one of $4,500 for widening the small channel at the upper end of Petty's Island to 200 feet; the other of $25,000 for continuing dredging in the main ship-channel opposite Port Richmond.

The former improvement was completed during the fiscal year as projected, 11,566 cubic yards of material having been removed; the other is now in progress and will be finished during the ensuing fiscal year.

The channel at the upper end of Petty's Island is now much used by vessels engaged in the up-river traffic. To make it navigable at all stages of the tide for the largest class of towing-steamers, it is proposed to dredge it to a mean low-water depth of 12 feet, for which purpose $5,000 could be profitably expended during the fiscal year ending June 30, 1885.

The extension of the main ship-channel past Port Richmond to the more northern parts of the city, which has been in progress since 1879, has proved of incalculable benefit to the shipping trade along this water front, which heretofore was debarred from including the largest class of foreign vessels on account of the insufficient depth of water. Steamers of 24 feet draught can now land at the largest (two) wharves at Port

Richmond without much difficulty, the docks and the entrances thereto having been dredged by the owners to the same depth as that of the main channel in the river.

It remains necessary, however, to extend the latter farther up the river and to make it wider, to facilitate the turning and docking of large vessels.

The improvement of the channel at Mifflin Bar was in progress during the past year under contracts of December 22, 1881, and June 16, 1882, respectively.

Operations were confined principally to the westerly portion of the channel, extending through the entire length of the same, the result of which was the deepening of the cut to 26 feet and increasing its width to 210 feet. The aggregate amount of material removed under both contracts was 135,194 cubic yards.

With an allotment of $40,000 from the general appropriation of $136,000 made for Delaware River by act which passed August 2, 1882, a contract was made with the New York Steam Dredging Company for continuing the improvement.

No work was done at the channel under this contract. The requisite timber structures on shore to form a basin for the dredged material were commenced and some progress made towards their completion.

It is proposed to complete the work under the present contract during this season by increasing the width of the existing 26-foot channel to 350 feet.

The removal of the pier in midriver, formerly the site of Fort Mifflin Light, opposite Fort Mifflin, is recommended.

The improvement of Mifflin Bar channel was commenced in 1873, the least depth over the bar at that time being slightly in excess of 17 feet.

The originally adopted project for this improvement provided for a channel 20 feet in depth and 900 feet in width, which was modified in 1874 to a depth of 22 feet and a width of 1,500 feet, and in 1878 again modified so as to increase the depth to 26 feet.

The condition of the work on June 30, 1883, showed a channel from the New Jersey channel south through the bar to the Pennsylvania channel on the north approximating a depth of 26 feet and a width of 210 feet.

The work of deepening and widening the channel at Bulkhead Shoals was continued until September 6, 1882, and was resumed under a new contract on June 6, 1883. A channel 24 feet deep has been made through the shoal with a width of 175 feet, which will be increased during the present season to 385 feet.

The officer in charge recommends that the work of improving Dan Baker Shoals be begun, and that the sum of $217,000 be appropriated for these several improvements on this part of the river for the fiscal year ending June 30, 1885.

The original condition of this portion of the river was as follows:

a. At Five Mile Point there were but from 6 to 7 feet in the navigable channel.

b. At Petty's Island Bar there were but 14 feet at low water in the navigable channel.

c. At Smith's Island Bar there was a navigable capacity across the bar of about 6 feet at low water.

d. At Mifflin Bar the navigable channel across the bar was about 18 feet deep at low water.

e. At Bulkhead Shoals the navigable channel across the shoals was about 21 feet at low water.

f. At Dan Baker Shoals the navigable channel varied from 19 to 23 feet at low water.

The originally-adopted project for this improvement was to increase the depth of channel across the first five obstructions to the width required by the commerce of the river, as follows:

At Five Mile Point to a depth of from 9 to 10 feet; at Petty's Island Bar, to 24 feet; at Smith's Island Bar, to 10 feet; at Mifflin Bar, to 20 feet, afterwards increased to 26 feet; and at Bulkhead Shoals, to 24 feet.

To the close of the year ending June 30, 1882, the sum of $478,356 had been expended on this improvement, which includes $135,000 expended on Mifflin Bar from 1836 to 1875, inclusive, and $50,000 appropriated in 1873 for the improvement of Horse-Shoe Shoals.

On that date a low-water channel 24 feet deep and 100 feet wide had been dredged through Petty's Island Bar. A low-water channel, 400 feet wide and 24 feet deep, had been maintained at Mifflin Bar, and the improvement at Bulkhead Shoals had been begun. The channel near Five Mile Point and across Smith's Island Bar were improved.

During the year ending June 30, 1883, the sum of $67,415.87 was expended and the cuts at Five Mile Point, Petty's Island, Mifflin Bar, and Bulkhead Shoals improved, and that across Smith's Island Bar finished. The first was of great benefit to the up-river commerce; the next three to the general commerce of the river, and the last to the large commerce between Philadelphia and Camden.

The amount which can be profitably expended during the year ending June 30, 1885, is $217,000, and it is proposed to expend it in continuing the improvement at the first, second, fourth, fifth, and sixth points above named, to the great advantage of the up-river and general commerce of the Delaware River. Until the results of the recent survey are known, no further recommendation can be made for Smith's Island Bar.

The amount estimated for completing the work according to the existing project is as follows:

Petty's Island Bar, $280,000; Mifflin Bar, $273,000; Bulkhead Shoals, $62,000; total, $553,000.

If the channel at the upper end of Petty's Island be deepened to 12 feet, as it should be, this total would be $558,000, and if the Dan Baker Shoals are improved it would be $763,000.

July 1, 1882, amount available		$74,821 91
Amount appropriated by act passed August 2, 1882		136,000 00
		210,821 91
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$88,464 97	
July 1, 1883, outstanding liabilities	1,117 02	
		89,581 99
July 1, 1883, amount available		121,239 92
Amount (estimated) required for completion of existing project		553,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		217,000 00

(See Appendix G 2.)

3. *Delaware River at Schooner Ledge.*—Operations on this work have continued during the past fiscal year, at the close of which the 24-foot mean low-water channel had been widened to 330 feet.

Contracts Nos. 2 and 3 were completed, and work under contract No. 4 is now in progress.

The original channel over this obstruction was only from 18 to 19 feet deep at low water, and was no longer available for the heavier class of vessels which navigate the Delaware River.

The originally adopted project for this improvement was to remove the fast rock and other obstructions above the 24-foot low-water plane. No amendments have yet been made to it.

The amount expended up to the close of the fiscal year ending June 30, 1882, was $107,638.22.

A channel 220 feet wide and of the proposed depth had been created at that date. This channel has been of great benefit to the commerce of the Delaware River in providing a safe passage for large vessels across what has heretofore been a serious and dangerous obstruction.

During the year ending June 30, 1883, the sum of $48,809.35 has been expended, and the results of this expenditure have been to widen the artificial 24-foot low-water channel from 220 feet to 330 feet.

The amount required for the fiscal year ending June 30, 1885, is $57,000. It is proposed to finish the work according to the existing project with that sum.

July 1, 1882, amount available		$16,377 54
Amount appropriated by act passed August 2, 1882		40,000 00
		56,377 54
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$44,344 75	
July 1, 1883, outstanding liabilities	4,464 60	
		48,809 35
July 1, 1883, amount available		7,568 19
Amount (estimated) required for completion of existing project		57,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		57,000 00

(See Appendix G 3.)

4. *Delaware River near Cherry Island Flats.*—The construction of a channel 900 feet wide, with a mean low-water depth of 24 feet, has been in progress here since 1880. During the past fiscal year the width has been increased from 390 to 470 feet.

Very little shoaling has occurred, and that only at the head of the cut, and this shoaling was due to vessels leaving the line of ranges too soon.

An annual appropriation of $100,000 is the least with which operations can be carried on continuously.

The original condition of the navigable channel across this obstruction was from 18 to 19 feet, and was no longer available for the larger class of vessels navigating the Delaware River.

The original project contemplated making a 24-foot low-water channel 900 feet wide across the obstruction. No alterations have been made in this project.

The amount expended on this work up to June 30, 1882, was $262,222.78.

On that date a channel 390 feet wide and of the desired depth had been made, and had become passable for vessels of the heaviest draught which navigate the river.

During the year ending June 30, 1883, the sum of $82,532.27 was expended here, and the channel was widened to 470 feet and to the desired depth.

The amount that can be profitably expended during the fiscal year

ending June 30, 1885, is $100,000, and if this is appropriated it is proposed to continue the widening of the artificial channel, and thus increase the facilities for heavy vessels passing this point.

July 1, 1882, amount available		$26,216 00
Amount appropriated by act passed August 2, 1882		100,000 00
		126,216 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$62,699 19	
July 1, 1883, outstanding liabilities	19,833 08	
		82,532 27
July 1, 1883, amount available		43,683 73
Amount (estimated) required for completion of existing project		122,720 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		100,000 00

(See Appendix G 4.)

5. *Frankford Creek, Pennsylvania.*—With the appropriation of $10,000, made by act passed August 2, 1882, a 7-foot low-water channel was dredged from the mouth of the creek to the Horseshoe Bend above Bridge Street Bridge. The channel was made as wide as the proximity and safety of the adjacent banks and wharves would permit. The amount of material dredged was 35,178 cubic yards.

The condition and irregularity of the present shore-lines, as yet not receiving any attention from the city authorities of Philadelphia, is such that no permanent improvement can be made, and the channel dredged will soon fill again.

The original condition of this work was a mean low-water width of 100 feet with a depth of about 5 feet at its mouth and practically nothing at the Frankford Avenue Bridge at the head of the tidal section.

The originally adopted project was, for its improvement, to obtain a low-water depth at the mouth of 7 feet, diminishing to 3 feet at Frankford Avenue Bridge, with a bottom width of 50 feet and side slopes of 1 on 3.

No money was expended on this work up to June 30, 1882.

A 7-foot low-water channel, as wide as the safety of the adjacent banks would warrant, was made from the mouth to the Horseshoe Bend above Bridge Street Bridge.

The benefit to be derived from this will be to enable vessels of greater draught to go up to the last named bridge.

If it is thought that the benefit which would be derived from this improvement will justify the expenditure, the sum of $30,000 should be appropriated for the fiscal year ending June 30, 1885. If this sum is appropriated it is proposed to expend it in completing the improvement.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$509 30	
July 1, 1883, outstanding liabilities	8,090 94	
		8,600 24
July 1, 1883, amount available		1,399 76
Amount (estimated) required for completion of existing project		30,000 00

(See Appendix G 5.)

6. *Schuylkill River, Pennsylvania.*—Dredging operations were in progress during the past year along the channel between the mouth and Girard Point Piers, between Girard Point Piers and Penrose Ferry Bridge, and between Penrose Ferry Bridge and Point Breeze.

The aggregate amount of material removed was 166,911 cubic yards. Of this amount 56,998 cubic yards were removed under the contract of September 6, 1881, and the balance under the existing contract of November 20, 1882.

In the original condition of this river there was a low-water channel entrance to the Delaware River of only 15 feet.

The project originally adopted for this work provided for a low-water channel 20 feet in depth and 100 feet wide from the mouth to Gibson's Point, and from that point to Chestnut Street Bridge a low-water depth of 18 feet. In 1875 the project was modified so as to increase the width to 300 feet with a low-water depth of 24 feet from the mouth to Girard Point. In view of the importance of this improvement, the officer in charge recommends that the present 24-foot low-water channel from the mouth to Girard Point be widened to 400 feet and the 20-foot low-water channel from Girard Point Piers to Gibson's Point to 250 feet.

To the close of the fiscal year ending June 30, 1882, the sum of $249,905.06 was expended. On that date the channel had been more or less improved between the mouth and Yankee Point and Point Breeze and Gibson's Point; great improvement was made in the facilities for the large amount of commerce which now enters the river.

During the year ending June 30, 1883, the sum of $49,874.12 was expended, and on that date there was a 24-foot low-water channel 270 feet wide, from the mouth to Girard Point Piers; from Girard Point Piers to Gibson's Point 150 feet in width and 20 feet low-water depth, and an 18-foot low-water channel from thence to Chestnut Street Bridge.

The amount that can be profitably expended during the year ending June 30, 1885, is $100,000. If appropriated it is proposed to widen the artificial channel with it to the great benefit and advantage of the large vessels that now desire to enter the river.

The estimated amount required for the entire completion of the amended project in force is $74,921, and for the project amended as recommended by the officer in charge, $234,921.

July 1, 1882, amount available		$54,093 94
Amount appropriated by act passed August 2, 1882		25,000
		79,093 94
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$39,389 15	
July 1, 1883, outstanding liabilities	10,484 97	
		49,874 12
July 1, 1883, amount available		29,219 82
Amount (estimated) required for completion of existing project		74,921
Amount that can be profitably expended in fiscal year ending June 30, 1885		100,000

(See Appendix G 6.)

7. *Ice harbor at Marcus Hook, Pennsylvania.*—During the past fiscal year the operations at this work have consisted in building Pier No. 7, or the outer one on the fourth line, about 225 feet outside of Walker's Wharf, and in wrecking Pier No. 5, or the outer one on the third line, which was destroyed on the evening of September 16, 1882.

The crib substructure of the former was sunk during May last, and as soon as this has settled the decking and superstructure will be built.

Two hundred and one face stones, seventy paving stones, over one hundred pieces of concrete, and 300 cubic yards of rubble have been raised from the wreck of Pier No. 5, and about one hundred of the piles have been drawn.

This harbor as originally designed was completed in 1871, and furnished a protected area against ice of about 3½ acres, where formerly there had been none. A project for the enlargement of this harbor so as to afford a sheltered space of about 14 acres was made in January, 1880, and was amended in October, 1881, with a view of still further increasing the sheltered area to about 18 acres.

The amount expended to June 30, 1882, was $130,203.88, and at that date the sheltered area of the harbor was about 8 acres.

Owing to the accident to Pier No. 5 and the dangerous condition of Pier No. 6, which requires the rebuilding of both, and the incomplete condition of Pier No. 7, no additional sheltered area has been obtained, but all the operations during the year were in that direction.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $40,000, and if this sum is appropriated it will be used in rebuilding Pier No. 6 and building a bulkhead along the shore and increasing the sheltered area.

July 1, 1882, amount available		$38,796 12
Amount appropriated by act passed August 2, 1882		15,000 00
		53,796 12
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$8,499 96	
July 1, 1883, outstanding liabilities	15,345 00	
	23,844 96	
July 1, 1883, amount available		29,951 16
Amount (estimated) required for completion of existing project		50,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		40,000 00

(See Appendix G 7.)

8. *Ice harbor at Chester, Pennsylvania.*—For reasons given in former reports, it is not proposed to make any further outlay of public funds for the maintenance of this harbor.

(See Appendix G 8.)

9. *Ice harbor at New Castle, Delaware.*—The additional ice-pier needed for this harbor was completed August 8, 1882.

Ice-pier "L," which had been damaged, was repaired. This completed the project as originally adopted. But ice-piers "K" and "N" need repairs; the anchorage in the harbor should be enlarged by dredging, and mooring-piles should be driven for the convenience of vessels using the harbor. The estimated cost of this additional work is $12,000.

(See Appendix G 9.)

10. *Ice harbor at the head of Delaware Bay.*—A preliminary report upon this harbor was made January 28, 1880. There is no protection for the large commerce of the Delaware River in this vicinity when the ice is running, the old harbor in rear of Reedy Island having become useless.

No money was expended on this work previous to June 30, 1882, as the work had not been begun.

During the year ending June 30, 1883, a contract was made for the removal of the old and sunken piers in rear of Reedy Island, and steps taken for a thorough examination and study of the work at an early date.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $100,000. If this sum is appropriated it is pro-

posed to expend it in beginning the harbor, and at as early a date as possible to provide some shelter for vessels in that locality when the ice is running.

Amount appropriated by act passed August 2, 1882	$25,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	74 78
July 1, 1883, amount available	24,925 22
Amount (estimated) required for completion of existing project	381,090 47
Amount that can be profitably expended in fiscal year ending June 30, 1885	100,000 00

(See Appendix G 10.)

11. *Wilmington Harbor, Delaware.*—With the appropriation of $50,000, made by the river and harbor act of August 2, 1882, the following work has been done:

The jetty on the north side of the mouth of the Christiana River has been carried out to the 15-foot curve and nearly completed. A cut 20 feet wide and 12 feet deep was made on the south side of the then existing cut, from a point about 100 feet above the Reading Railroad Wharf to the upper end of the Pulp Works Wharf, by the removal of 12,552 cubic yards of stiff mud mixed with sand and wood refuse. Two cuts, each 20 feet wide and furnishing a low-water depth of 13 feet, were made from the center of the draw of the Market Street Bridge to a point opposite Warner's Coal-hoist, by the removal of 1,120 cubic yards of hard gravel and clay intermixed with bowlders. One hundred and seven thousand and six cubic yards of soft mud, slightly tempered in places with sand, were removed from the mouth of the Christiana River, beginning at the 15-foot curve in the Delaware River and extending up stream a distance of 4,200 feet.

The original entrance into this harbor was a narrow channel from the Delaware River, with a minimum depth of 9 feet at low water.

The originally adopted project for this work provided for a low-water channel of 12 feet in depth, its width varying from 75 to 150 feet from Market Street Bridge, Wilmington, to the mouth of the river. This project was amended so as to provide a low-water channel 15 feet in depth, of suitable width, from the mouth of the Christiana River to above the city of Wilmington.

At the close of the fiscal year ending June 30, 1882, the total amount expended was $100,522.22.

At that date a 12-foot low-water channel, 150 feet wide, extended from the mouth to Harlan and Hollingsworth's ship-yard; thence 100 feet wide to the Delaware Western Railroad Bridge; thence 90 feet wide to a point about 200 yards below the Pulp Works, and thence 40 feet wide through the remaining distance. This already afforded great relief to the large commerce of Wilmington.

During the year ending June 30, 1883, the sum of $78,639.16 was expended. On that date the condition of the work was as above stated, showing a large increase in width and depth and increasing the facilities for commerce in a corresponding degree.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $75,000. If this sum is appropriated it is proposed to expend it in removing the old light-house piers at the mouth; to riprap the foot of the jetty, and to continue the enlargement of the artificial channel; all of which will be of benefit to the work and increase the facilities for commerce.

July 1, 1882, amount available		$32,443 58
Amount appropriated by act passed August 2, 1882		50,000 00
		82,443 58
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$68,226 23	
July 1, 1883, outstanding liabilities	10,412 93	
		78,639 16
July 1, 1883, amount available		3,804 42
Amount (estimated) required for completion of existing project		191,384 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		75,000 00

(See Appendix G 11.)

12. *Broadkiln River, Delaware.*—In the original condition of the river a narrow, shallow, and tortuous channel existed, which was nearly dry at its entrance into Delaware Bay at low water, and navigable only for small vessels.

A survey was made, and the report and estimates based on this were submitted September 11, 1872. The original project was to reopen "Old Inlet," and to dredge the river to obtain a 6-foot low-water channel.

The amount expended on this work to June 30, 1882, was $11,022.42. This was expended in dredging the main shoals and in a re-examination of the stream. The dredging which was done filled in and was of little benefit to commerce. Nothing has been done since.

If it is thought that the benefits to be derived here will justify the expenditure, the sum of not less than $31,500 should be appropriated for the fiscal year ending June 30, 1885. If this sum is appropriated, it will be expended with the available balance in completing the improvement.

July 1, 1882, amount available		$8,977 58
Amount appropriated by act passed August 2, 1882		5,000 00
		13,977 58
July 1, 1883, amount available		13,977 58
Amount (estimated) required for completion of existing project		31,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		31,500 00

(See Appendix G 12.)

13. *Mispillion Creek, Delaware.*—The sum of $3,000 appropriated by the river and harbor act of August 2, 1882, has been expended in continuing the improvement of this creek according to the existing project.

The contract was made October 31, 1882. Work was begun on December 21, 1882, and completed on February 7, 1883. A 6-foot low-water channel, 40 feet wide, was made through the shoal from "Fork" to "Reed's" and "Watson's," and one cut 28 feet wide and 6 feet deep through "Reed's" and "Watson's" shoals; 5,720 cubic yards of material were removed. The results of this improvement have been quite satisfactory. If the bar at the mouth were improved, still greater benefit would result.

Mispillion Creek originally was a tortuous stream emptying into Delaware Bay and extending beyond the town of Milford, the head of navigation, 18 miles above. It was about 80 yards wide at its mouth and 30 yards wide at Milford. The entrance to the creek had a depth of about 1½ feet at low-water. There were several shoals in it, on which the depth of water ranged from 4 to 5 feet.

The originally adopted project consisted in improving the entrance, at a cost of $7,000, and removing the shoals in the creek, at an expense

of $3,000. These estimates have since been found entirely too low and were revised.

Up to the close of the fiscal year ending June 30, 1882, the sum of $9,945.68 was expended on this improvement. On that date the entrance to the creek was unchanged, but the dredging done in the creek had improved its navigable capacity, and the work done was of much benefit to the ship-building and commercial interests of the locality.

The amount that can be profitably expended here, if it is desired to continue the work, during the fiscal year ending June 30, 1885, is $58,500, and with this amount it is proposed to complete the improvement.

July 1, 1882, amount available	$54 32
Amount appropriated by act passed August 2, 1882	3,000 00
	3,054 32
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,054 32
Amount (estimated) required for completion of existing project	58,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	58,500 00

(See Appendix G 13.)

14. *Duck Creek, Delaware.*—The $2,000 appropriated for continuing this work by the river and harbor act of August 2, 1882, was placed under contract on October 3, 1882. The fourth cut through the bar was nearly completed when the appropriation was exhausted.

The object of this improvement is to obtain an 8-foot low-water channel from Delaware Bay to the town of Smyrna, a distance of about 12 miles.

Unfortunately, the cuts which were made through the bar in 1880 and 1881 are completely filled up, and no further work is recommended here until a resurvey of the entrance to the creek can be made.

In its original condition this creek was a tortuous, narrow stream, about 15 miles in length, emptying into the Delaware River, and navigated at high water by vessels drawing 7 feet to Smyrna Landing, 8 miles above its mouth. The available depth over the bar at its entrance was about 3 feet.

The original project for its improvement consisted in the removal of the shoals in the creek, widening the old "cut-off" above the phosphate works and improving the entrance. The estimated cost of this project was $12,000. This estimate was subsequently found to be too low, and a revised estimate was submitted on January 29, 1881.

Up to June 30, 1882, the sum of $8,000 had been expended on this improvement.

On that date an 8-foot low-water channel, 600 yards in length and 75 feet wide, had been made across the bar.

During the fiscal year ending June 30, 1883, the sum of $2,000 was expended and the widening of the artificial channel through the bar to 100 feet carried as far as the money would allow.

During the progress of the last season's work it was found that the portion of the channel made in 1880 and 1881 had completely filled up, and it does not seem advisable to expend any more money here until a resurvey of the entrance to the creek can be made.

Amount appropriated by act passed August 2, 1882	$2,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	2,000 00
Amount (estimated) required for completion of existing project	12,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	12,000 00

(See Appendix G 14.)

15. *Cohansey Creek, New Jersey.*—During the past year the appropriations of $7,000 by act of March 3, 1881, and $5,000 by act of August 2, 1882, have been expended in widening and straightening the 7-foot low-water channel up as far as Broad Street Bridge, Bridgeton. This channel is now 90 feet wide between the lower and upper steamboat wharves, and 70 feet above that to the bridge.

The gas and water mains of the city of Bridgeton cross the creek at Broad street at a level of only 4 feet below low water, and prevent the use of any further deepening of the channel above them. The city authorities, however, intend lowering these pipes to a proper depth. In that event the amount required to complete the project by carrying a 6-foot low-water channel to the "Nail Works" Bridge would be about $5,500.

Cohansey Creek in its original condition was navigable to Bridgeton, 20 miles above its mouth, through a tortuous channel of ample depth. The obstructions to its free navigation were found at Bridgeton and at its mouth, where the river discharged across a soft mud-bar without any well defined channel.

The original project contemplated the construction of a channel at Bridgeton 130 feet wide and 4 feet deep, at a total cost of $30,000. This was modified to reduce the width to 80 feet and to increase the depth at mean low water to 7 feet from the lower steamboat landing to the bridge, and above that point to 5 feet. This modified project was approved May 14, 1879. This project was again amended in June, 1880, and approved. It contemplates bringing the 7-foot low-water channel from deep water below the lower steamboat landing upward as far as the Commerce Street Bridge, and thence to the "Nail Works" Bridge a low-water channel of 6 feet, the channel to be 100 feet wide at its lower end and decrease to 50 feet at the upper bridge.

Up to June 30, 1882, the total amount expended on this improvement was $24,501. On that date a low-water channel of 7 feet had been made to Broad Street Bridge, with an average width of 70 feet, and between Broad and Commerce Street bridges a narrower one of the same depth, and large vessels could navigate the river farther up.

The amount expended during the fiscal year ending June 30, 1883, was $10,800.65, and the artificial channel was widened and straightened.

The amount that can be profitably expended during the year ending June 30, 1885, is $5,500, and if this sum is appropriated, it is proposed to complete the improvement according to the existing project.

July 1, 1882, amount available	$6,498 41
Amount appropriated by act passed August 2, 1882	5,000 00
	11,498 41
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	10,800 65
July 1, 1883, amount available	697 76
Amount (estimated) required for completion of existing project	5,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	5,500 00

(See Appendix G 15.)

16. *Salem River, New Jersey.*—Proposals were invited to continue the improvement of the shoals at Biddle's Landing, under the appropriation of $1,500 made by the river and harbor act of August 2, 1882. Only one bid was received. This was so excessive that it was rejected and further action in the matter postponed.

The original navigable capacity of this stream was 6 feet at low water

over the bar in Salem Cove, and 3 to 4 feet at low water on the shoals at Biddle's Landing.

The originally adopted project consisted in dredging an 8-foot low-water channel, as wide as the vessels needed, through the bar in Salem Cove. Subsequently the field of operation was changed to removing the shoals in the canal and river above the latter.

The amount expended on this work to June 30, 1882, was $12,862.07. On that date a low-water channel of 8 feet, with a width of 110 feet, had been made through the bar in Salem Cove, and a channel 60 feet in width and from 6 to 7 feet deep at low water had been dredged from the head of the canal to a point about 200 feet above Biddle's Landing.

The amount expended during the fiscal year ending June 30, 1883, was $147.27 for contingent expenses, and no further work has been done.

If it is concluded to continue the work, the sum of $4,000 can be profitably expended during the fiscal year ending June 30, 1885, in continuing the improvement up stream.

The estimated amount required for the completion of this work according to the existing project, that is, to Hoxie's Landing, is $4,000. If the improvement is carried up to Sharptown, the amount will be $37,000.

July 1, 1882, amount available	$137 93
Amount appropriated by act passed August 2, 1882	1,500 00
	1,637 93
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	147 27
July 1, 1883, amount available	1,490 66
Amount that can be profitably expended in fiscal year ending June 30, 1885.	4,000 00

(See Appendix G 16.)

17. *Chester Creek, Pennsylvania.*—The amount available for this work for the last fiscal year was placed under contract on October 6, 1882, and the work was closed on March 6, 1883. The result accomplished has been to obtain a channel 60 feet wide, with a diverging mouth, with a depth of 7½ feet at mean low water, where formerly there was only 4½ feet. This channel extends to about 75 feet above Second Street Bridge, Chester, Pa., and is sufficient for all present needs of commerce on the creek; 10,613 cubic yards of material have been removed.

July 1, 1882, amount available	$2,927 08
Amount appropriated by act passed August 2, 1882	3,000 00
	5,927 08
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	5,927 08

(See Appendix G 17.)

18. *Rancocas River, New Jersey.*—The Rancocas River was originally a stream of good natural capacity, about 600 feet wide at its mouth and a little over 400 feet at the Forks, 8 miles above. A draught of between 7 and 8 feet at low water could be carried into it from the Delaware River. Here and there were shoals and bars on which the navigable capacity was much less than in other portions of the stream.

The original project provided for a low-water channel from 150 to 200 feet wide, and 6 feet deep at low water, to Centreton, 7¼ miles above the mouth; and eventually a 5-foot low-water channel to Mount Holly, 5¾ miles above Centreton. The estimated cost of the whole was $82,000.

The amount expended up to June 30, 1882, was $10,000. On that date a dike had been built from the head of Hamill's Island to the north bank of the river and a 6½-foot low-water channel, 85 feet wide, cut through Coates's Bar.

During the year ending June 30, 1883, the sum of $9,148.10 was expended, and the channel through Coates's Bar widened to 150 feet.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $25,000, and if appropriated, it is proposed to expend it in carrying the improvement up stream by dredging the shoals in the order in which they appear.

Amount appropriated by act passed August 2, 1882	$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	9,148 10
July 1, 1883, amount available	851 90
Amount (estimated) required for completion of existing project	62,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	22,000 00

(See Appendix G 18.)

19. *Saint Jones River, Delaware.*—It having been decided to defer the expenditure of the $5,000 appropriated for this work in the river and harbor act of March 3, 1881, until further action by Congress, nothing has been done towards applying the amount now available.

This stream has a high-water navigation of 6 feet to Lebanon, and of 5 feet to Dover, and at its mouth there is a bar on which there is but little water at low stages of the tide.

The original project consisted in obtaining a 3-foot low-water channel through the bar at the mouth, at an estimated cost of $35,000.

The amount expended to June 30, 1882, was $117.90 on contingencies. No further expenditures have been made for the reasons stated above.

If it is desired to make this improvement, the sum of $30,000 should be appropriated for the fiscal year ending June 30, 1885. If this sum is appropriated, it is proposed to expend it in improving the channel across the bar at the mouth of the river.

July 1, 1882, amount available	$4,882 10
July 1, 1883, amount available	4,882 10
Amount (estimated) required for completion of existing project	30,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	30,000 00

(See Appendix G 19.)

20. *Maurice River, New Jersey.*—This river in its lower section varies from 500 to 1,000 feet in width, with channel depths in excess of 10 feet, and long stretches of 20 feet and over. Soon after emerging into Maurice River Cove, the 10-foot curve closes and then the 6-foot, leaving an available low-water depth of about 5 feet. The rise of tide at the entrance is 6.1 feet. This obstruction, and some that exist in the 4 miles below Millville, situated 24 miles from the mouth, constitute the difficulties to navigation.

The original project consisted in improving the navigation of the 4 miles above referred to by a 6-foot low-water channel, 100 feet wide as far up as Millville; and a short distance along the city front a 4-foot low-water navigation. The estimated cost of the improvement was $112,000.

Nothing had been expended up to June 30, 1882, and nothing since.

If the work is to be done, not less than $40,000 can be profitably expended during the fiscal year ending June 30, 1885. With this sum, if appropriated, it is proposed to commence the artificial channel below Millville.

Amount appropriated by act passed August 2, 1882	$3,000 00
July 1, 1883, amount available	3,000 00
Amount (estimated) required for completion of existing project	109,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	40,000 00.

(See Appendix G 20.)

21. *Mantua Creek, New Jersey.*—The head of navigation of this creek is Mantua, 11 miles from its mouth. In the lower third of these 11 miles the 9-foot low-water curve is nearly continuous; in the next third the 6-foot curve predominates, and in the upper third this depth decreases to 4 feet, being at Mantua only 2 feet.

The original project contemplates the construction of a low-water channel, which shall be 10 feet deep and 80 feet wide at the mouth of the creek, and diminish to 4 feet deep and 40 feet wide at Mantua. The estimated cost of the work is $35,000. No money has yet been expended on the work. If it should be begun the sum of $32,000 can be profitably expended during the fiscal year ending June 30, 1885. If this sum is appropriated, it is proposed with it and the amount now available to complete the improvement.

Amount appropriated by act passed August 2, 1882	$3,000 00
July 1, 1883, amount available	3,000 00
Amount (estimated) required for completion of existing project	32,000 00

(See Appendix G 21.)

22. *Woodbury Creek, New Jersey.*—The lower part of Woodbury Creek, that is, from its mouth to the Broad Street Bridge in the town of Woodbury, N. J., in its present condition is navigable at high water for vessels drawing from 5½ to 6 feet. It is crossed by three bridges. The one at the head of navigation (Broad Street Bridge, Woodbury) is a permanent bridge; the other two (Red Bank Road Bridge and Crown Point Road Bridge), further down stream, are draw-bridges.

The navigation to the Crown Point Road Bridge being satisfactory, the project submitted in the report on the survey, dated January 16, 1883, was for improving the creek from said bridge to the Broad Street Bridge, so as to obtain a temporary channel of 8 feet at high water, with a bottom width of 40 feet, at an estimated cost of $15,000. This channel, when once made, is to be maintained by the parties interested.

Nothing was expended on this work up to June 30, 1882.

During the fiscal year ending June 30, 1883, the sum of $450.31 was expended on the survey of the creek.

If this work is to be carried on the sum of not less than $10,500 should be appropriated for the fiscal year ending June 30, 1885. If this sum is appropriated it is proposed to expend it, with the available balance, in completing the work.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	450 31
July 1, 1883, amount available	4,549 69
Amount (estimated) required for completion of existing project	10,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	10,500 00

(See Appendix G 22.)

23. *Racoon River, New Jersey.*—Racoon River has a high-water width at its mouth of about 450 feet, gradually diminishing to 100 feet at Swedesborough, about 9½ miles upstream. There is a good 4-foot low-water channel and a high-water channel of from 9 to 10 feet from the mouth of the river to more than half the distance to Swedesborough. The serious and extensive obstructions are found within 2 miles of this

town. There are four bridges across the stream. Two of these are located at Bridgeport, about 2 miles above the mouth of the river, and the other two at Swedesborough. The lower one of the two latter is the Swedesborough Railroad Bridge, and barges can pass under it; the upper one is the Main Street Bridge, and is the head of navigation.

The project submitted with the report on the survey of the river, dated February 26, 1883, contemplates making the navigation up to Main Street Bridge in Swedesborough more safe and less difficult for the class of vessels now navigating the stream, by dredging, the estimated cost of the work being $17,940.

Nothing was expended on this work up to June 30, 1882.

During the fiscal year ending June 30, 1883, the sum of $757.23 was expended for surveys.

If this work is to be executed the sum of $16,000 can be profitably expended during the fiscal year ending June 30, 1885, and, if appropriated, will be expended in completing the improvement.

Amount appropriated by act passed August 2, 1882	$3,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	757 23
July 1, 1883, amount available	2,242 77
Amount (estimated) required for completion of existing project	16,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	16,000 00

(See Appendix G 23.)

24. *Indian River, Delaware.*—The main obstruction in the Indian River in its original condition consisted in "The Bulkhead," over which there was a depth of only about 2 feet at low water; the bar at its mouth, with a depth over it of only about 2 feet at mean low water, and a few obstructions in Indian River proper.

The original project consisted in dredging a channel 80 feet wide and 4 feet deep through "The Bulkhead"; thence a channel straight to the inlet, protecting it by means of a dike on its northern side, through to the outer, or sea beach, and to construct a >-shaped dike to bring the currents on each side of Burton's Islands into more regular confluence. The estimated cost of this project was $50,000.

Nothing had been expended here up to June 30, 1882.

During the fiscal year ending June 30, 1883, the sum of $1,392.16 was expended and 2,476 cubic yards of material were removed from "The Bulkhead."

If this work is to be completed, the sum of $35,000 should be appropriated for the fiscal year ending June 30, 1885, and if this sum be appropriated it is proposed to expend it on "The Bulkhead," the channel through the beach, and begin the dike.

The dredging here will cost more than the original estimate, and the work will certainly cost $60,000. Its entire completion, therefore, will require the sum of $50,000.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$537 94	
July 1, 1883, outstanding liabilities	854 22	
		1,392 16
July 1, 1883, amount available		8,607 84
Amount (estimated) required for completion of existing project		50,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		35,000 00

(See Appendix G 24.)

25. *North Branch of Susquehanna River, Pennsylvania.*—During the past fiscal year 5,433 cubic yards of gravel were dredged from the Forty Fort Shoal, completing a channel 60 feet wide and 4 feet deep, and the work at Hillman's Riffle was completed by the removal of 927 cubic yards of rock.

That part of the appropriation made by the river and harbor act which passed August 2, 1882, which remained available, after the survey of the river between Pittston and Athens had been made, was placed under contract on April 30, 1883, and work was commenced about the middle of last May.

The work is to consist of deepening shoal places between Plymouth and Wilkes-Barre, and of the modification of the water-slope at the Gas-House Riff by constructing parallel training walls at the foot of the slope.

Up to June 30, 1883, 3,071 cubic yards had been removed from the several points at the head and foot of the former dredged channels at Richard's and Wilkes-Barre Islands.

The North Branch of the Susquehanna River is a stream which is only navigable at high stages of the water. At low stages there are over 12 miles of bars and shoals which are nearly dry. It is crossed by numerous bridges.

A preliminary examination of the stream was made in the latter part of 1879, and a report submitted under date of January 22, 1880, in which the cost of obtaining a 2 to 3 foot low-water navigation from Athens to Nanticoke Dam was placed at $200,000.

No general project for the improvement has, however, been made, and the various appropriations have been expended under projects submitted for each.

The total amount expended here up to June 30, 1882, was $19,094.60. At that date the projected work of improvement had been completed as far up as Wilkes-Barre.

During the fiscal year ending June 30, 1883, the sum of $13,187 was expended with the results stated above.

In the opinion of the officer in charge no money can be profitably expended in carrying out the present project.

July 1, 1882, amount available		$5,255 38
Amount appropriated by act passed August 2, 1882		15,000 00
		20,255 38
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$11,772 80	
July 1, 1883, outstanding liabilities	1,414 20	
		13,187 00
July 1, 1883, amount available		7,068 38
Amount (estimated) for completion of existing project		205,000 00

(See Appendix G 25.)

26. *Construction of Iron Pier in Delaware Bay, near Lewes, Delaware.*—With the appropriation of $13,000 made by the river and harbor act which passed August 2, 1882, the following had been done up to the end of the past fiscal year.

Five hundred feet, or the entire wide part of the pier, were torn up and the decayed timbers replaced by fifty new stringers, twenty-eight cross-beams, and one hundred and seventy floor-joists. All the bolts in this part were worked over and their threads recut.

The railroad iron for one main track the entire length of the pier, and

two sidings on the wide part, with the necessary spikes, fish-plate joints, &c., and two safety switches, were purchased. This structure was erected for the accommodation of the vessels which would be driven to take shelter in the Delaware Breakwater Harbor.

The original project was to build it of a combination of wrought-iron screw-pile shafts and cast-iron caps and screws, with a superstructure of yellow pine timber. It was to be 1,701 feet long and to reach 22 feet at low water. This project has since substantially governed all operations here.

The sum of $353,546.41 was expended up to June 30, 1882. On this date the substructure had been finished; the superstructure of the narrow part of the pier had been laid according to project, but required complete rebuilding on account of decay; that of the pier-head had been recently removed, awaiting reconstruction, and all the fender-piles were in place and connected with the pier.

During the fiscal year ending June 30, 1883, the sum of $8,506.86 has been expended with the results stated above.

The sum of $12,000 can be profitably expended during the fiscal year ending June 30, 1885, and, if this sum is appropriated, it is proposed to place the pier in good order.

July 1, 1882, amount available	$1,274 05
Amount appropriated by act passed August 2, 1882	13,000 00
	14,274 05
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	8,506 86
July 1, 1883, amount available	5,767 19
Amount (estimated) required for completion of existing project	12,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	12,000 00

(See Appendix G 26.)

27. *Delaware Breakwater Harbor, Delaware.*—The contractors for delivering the lumber, bolts, nuts, washers, spikes, and railroad iron completed their deliveries promptly.

The lowest bidder for granite at the first letting refused to enter into contract, claiming that he had made an error in his figures. It was readvertised.

The contractor for creosoted piles, railroad ties, and brush has completed the delivery of the first two classes of material, but is far behind with the brush. The contractor for the granite is also far behind, and is giving much trouble by attempting to deliver stone not in accordance with the contract.

This harbor was begun in 1829, and work stopped on it in 1869. It was built to furnish shelter in stormy weather.

The original project, which has been substantially carried out, was to construct two massive works on the riprap system in the concavity of the bay, just inside Cape Henlopen; the greater of these works, called the "Breakwater," to afford safe anchorage during gales from the north and east, and the other, called the "Ice Breaker," to protect shipping against northwesterly gales and the heavy drifting ice of the bay, the two works to be separated by an interval or gap about one-quarter of a mile in length.

The protected area became smaller from year to year in comparison with the number of vessels which desired to use it, and lately a positive deterioration in the harbor itself began. It was then concluded to close the gap between the Breakwater and Ice Breaker.

The project is to close this gap by means of a concrete superstructure resting upon a riprap foundation, at an estimated cost of $550,000.

No money had been expended on this work up to June 30, 1882.

During the fiscal year ending June 30, 1883, the sum of $76,701.75 was expended in getting a plant ready for the work; in purchasing material by contract for the work itself, and in making fascines for paving the bottom of the proposed riprap foundation.

During the fiscal year ending June 30, 1885, the sum of $250,000 can be profitably expended here. If this sum is appropriated it is proposed to drive the piles and build the railroad track across the gap and begin the construction of the riprap foundation.

Amount appropriated by act passed August 2, 1882		$125,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$17,379 35	
July 1, 1883, outstanding liabilities	59,322 40	
		76,701 75
July 1, 1883, amount available		48,298 25
Amount (estimated) required for completion of existing project		425,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		250,000 00

(See Appendix G 27.)

28. *Removal of wrecks from Dalaware Breakwater Harbor, Bay, and River.*—In view of the provision in the river and harbor act of August 2, 1882, authorizing the application to localities in Delaware River and Bay of any unexpended balance of appropriation of January 13, 1880, for the removal of wrecks in Delaware Breakwater Harbor, orders have been given to remove the wrecks of the schooner Trade Wind, lying off the mouth of Maurice River, New Jersey, and the wreck of a sand-boat, lying off the mouth of the Delaware and Raritan Canal, New Jersey.

July 1, 1882, amount available	$5,289 47
July 1, 1883, amount available	5,289 47

(See Appendix G 28.)

29. *Removing sunken vessels obstructing or endangering navigation.*—The wreck of the Cassandra, on Brigantine Shoals, coast of New Jersey, having been removed as mentioned in the last annual report, payment was made to the contractors, on August 25, 1882, amounting to $15,000.

The net proceeds of the sale of the wreck were $367—which were turned into the United States Treasury.

(See Appendix G 29.)

30. *Port Warden's Lines, Philadelphia, Pennsylvania.*—The Port Warden's line for the Schuylkill River has been agreed upon by the Board of Harbor Commissioners and the United States Advisory Commission and the line for the Delaware River is now under discussion and study.

(See Appendix G 30.)

EXAMINATIONS AND SURVEYS FOR IMPROVEMENT.

To comply with provisions of the river and harbor act of March 3, 1881, Lieut. Col. G. Weitzel, Corps of Engineers, is charged with—

1. *Survey of Delaware River.*—This survey is still in progress. His predecessor, Maj. William Ludlow, Corps of Engineers, was charged with the following surveys:

2. *Five Mile Point, below Bridesburg, Delaware River.*

3. *The harbor of Delaware Breakwater and entrances thereto.*

Charts showing the results of these surveys were received at this office August 25, 1882.

IMPROVEMENT OF HARBORS AND RIVERS ON EASTERN SHORE OF CHESAPEAKE BAY, AND OF THE SUSQUEHANNA AND PATAPSCO RIVERS, IN MARYLAND; OF BROAD CREEK, DELAWARE; OF JAMES AND APPOMATTOX RIVERS AND ONANCOCK HARBOR, VIRGINIA; OF GREAT KANAWHA, ELK, AND SHENANDOAH RIVERS, WEST VIRGINIA; OF NEW RIVER, VIRGINIA AND WEST VIRGINIA; AND OF CAPE FEAR RIVER, NORTH CAROLINA.

Officer in charge, Lieut. Col. William P. Craighill, Corps of Engineers, having under his immediate orders Capt. E. H. Ruffner, Corps of Engineers, until August 23, 1882, and Capt. Thomas Turtle, Corps of Engineers, and Lieut. C. McD. Townsend, Corps of Engineers.

1. *Susquehanna River, near Havre de Grace, Maryland.*—The first appropriation by the United States for this river was made in 1852, and an examination soon after showed that the navigation was obstructed by two shoals between the light-house at Havre de Grace and Spesutie Island, upon which there were, respectively, depths of 5 and 6 feet at mean low-water.

The originally adopted project for the improvement was to increase the depth by dredging to 12 feet at mean low water. This has been done several times, but such an improvement not having been found to be permanent, it was proposed by the officer in charge in 1867 to contract the waterway by using a long jetty or deflector, commencing nearly opposite Havre de Grace. This idea was executed in 1868 and 1869 to as great an extent as the limited amount of funds available would allow, and the effect was found to be good.

An examination of the river made in August, 1881, showed that the effects of the last dredging to 12 feet depth at low water done between September, 1880, and April, 1881, had been obliterated under the action of freshets, ice, and the usual currents of the river and the tides. The subject of the continuance of operations on the river was presented in a special report from the officer in charge, dated January 16, 1882, which was printed on pages 837, 838, and 839 of the Annual Report of the Chief of Engineers for 1882, Part I. This report contained estimates for a permanent improvement of the channel to the respective depths of 12 and 15 feet at mean low water, and for certain work desired by the United States Commissioner of Fisheries.

An appropriation of $25,000 was made by the act of August 2, 1882, of which the phraseology was as follows:

> Improving Susquehanna River above and below Havre de Grace, Maryland, twenty-five thousand dollars, of which sum seven thousand five hundred dollars shall be expended above the bridge, and five thousand dollars for the completion of the channel to the Fishing Battery Light-House, and for strengthening and extending the piers and breakwater for the protection of said channel.

In order to determine accurately the proper locations to expend the money, a careful resurvey was necessary and was made. It was completed in October, 1882. As soon as the map could be finished and the plans prepared, a contract was made for some dredging, which seemed indispensable for the immediate relief of navigation. This would have been done in the spring of 1883 but for the opposition to interference with the fishing for shad and herring, a very important industry in that section. This dredging is to be completed in 1883. The main object of the dredging above Havre de Grace is to give a freer escape to the ice, and prevent the excessive and hurtful gorging which sometimes occurs there. It will be to a depth of 7 feet. That below in the channel will

be to 12 feet at mean low water, and that at the fishery station to 7 feet. The rise of tide is about 1.75 feet.

Some work has been done at the fishery station in the last fiscal year, chiefly consisting in strengthening by an enrockment the cribs which protect the basin, providing some openings for a better circulation of the water in the basin, and providing a platform for the nets.

Though, as has been more than once stated, the use of jetties or regulating works is positively indispensable to permanence of channel, and a dredged channel here will certainly fill up in one or two years, so much objection is made by the large capital and population interested in the fisheries to the placing of the regulating works, as they would certainly interfere seriously with the nets, it is a question for Congress to decide whether at once to appropriate money enough—$100,000—for these regulating works to be put in to the detriment of the fishery interests, or to appropriate $20,000 annually for dredging.

The estimate herewith presented includes $100,000 for jetties and $20,000 for dredging, as this will probably be necessary once more before the jetties can be built, even if money be provided for them. It should also be borne in mind that injuries to the jetties from floating ice may be annually expected unless they be built in a very costly manner, and that an annual appropriation of $10,000 may be necessary to keep the jetties in order, and to build and maintain beacons and lights upon them.

The amount expended on this river up to June 30, 1882, was $97,222.46, and up to June 30, 1883, $103,676.76. The available funds will be exhausted in 1883.

July 1, 1882, amount available		$167 54
Amount appropriated by act passed August 2, 1882		25,000 00
		25,167 54
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$6,431 29	
July 1, 1883, outstanding liabilities	23 01	
		6,454 30
July 1, 1883, amount available		18,713 24
Amount (estimated) required for completion of existing project		120,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		120,000 00

(See Appendix H 1.)

2. *Northeast River, Maryland.*—No appropriation was asked or made for this river for the year ending June 30, 1883, and none is required for the year ending June 30, 1884.

(See Appendix H 2.)

3. *Elk River, Maryland.*—The first appropriation by the United States for this river was in 1874, previous to which the channel in some places was not over 12 inches deep at low water, with an average rise of tide of only about 2¼ feet.

In much of the river, however, the depth was great, in some places being not less than 24 feet. The width near the town of Elkton is 100 feet, and for 2½ miles below averaged about 200 feet. The width increases to three-quarters of a mile at the mouth, which is 16 miles below Elkton.

The plan for the improvement has been the building of a dike 900 feet long on the right bank of the stream, beginning about 1,100 feet below

the bridge; the dredging of a channel 8 feet deep at mean low water, 60 feet wide, with a turning basin at the town.

The amount expended up to June 30, 1882, was $15,000, with the results stated above. An appropriation of $6,500 was made August 2, 1882. A part of this was applied in March, 1883, to the removal of the old dike which had become decayed. The earth which had been dredged from the river and put behind the dike, having been consolidated, was at the same time sloped back. The river has thus a better bank than by nature, as it has a better direction. A recent resurvey of the river has shown the importance of widening the channel for the accommodation of the vessels trading on it. This will be done in 1883. An old crib near Frenchtown will also be removed. The effect of the improvement has been to increase notably the amount of freighting on the river and to cheapen the rates by allowing successful competition with the railways. The end of 1883 is expected to find the available balance of funds exhausted.

Amount appropriated by act passed August 2, 1882	$6,500 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	944 42
July 1, 1883, amount available	5,555 58

(See Appendix H 3.)

4. *Chester River, Maryland, from Spry's Landing to Crumpton.*—This portion of Chester River is only 2 miles long. It is on the eastern shore of Maryland, nearly opposite the city of Baltimore. Seven feet of water can be carried at all stages of the tide to Spry's Landing, which is 7 miles above Chestertown, the most important town in that section. From Spry's Landing to Crumpton only 6½ feet could be carried at high water. The range of the tide in that part of the river is about 2 feet. The bridge at Crumpton is somewhat of an obstruction to navigation, the width of the draw being but 37½ feet. Above Crumpton the channel is narrow and considerably more shallow than below.

A report to Congress relative to this river was made early in the session of 1880–'81. Estimates were presented for making a channel 8 feet deep at mean low water, and with widths, respectively, of 100 and 120 feet, which amounted to $11,000 and $13,000.

An appropriation of $6,500 was given March 3, 1881. With it a channel was dredged between November, 1881, and the middle of March, 1882, through the shoal above Spry's Landing and the two bars above. The channel was made 70 feet wide and 8 feet deep at mean low water, the length dredged over being 3,850 feet.

Between Spry's and Crumpton the river is of a width varying from 1,600 to 2,000 feet, with a natural 8-foot channel of a width varying from 150 to 300 feet between the bars and shoal, where dredging has been done. The navigation of a dredged channel 70 feet in width is somewhat difficult, and the appropriation of $6,500 of August 2, 1882, has been applied to widening that channel to 120 feet, as originally proposed.

Chester River separates the counties of Kent and Queen Anne, both of which are naturally rich and fruitful, producing large amounts of grain and fruit. The river is the natural route of these products to a market. Its decided improvement, which has been effected with the funds available, will doubtless increase the facilities for moving these crops. Besides too regular lines of passenger and freight steamers between Baltimore and Crumpton, and several sailing vessels which carry freight, there are other steamers and sailing vessels making occasional trips in busy seasons.

July 1, 1882, amount available		$166 84
Amount appropriated by act passed August 2, 1882		6,500 00
		6,666 84
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,231 32	
July 1, 1883, outstanding liabilities	322 21	
		3,553 53
July 1, 1883, amount available		3,113 31

(See Appendix H 4.)

5. *Corsica Creek, Maryland.*—Corsica Creek, on the eastern shore of Maryland, enters Chester River about 13¾ miles from its mouth. The distance from the mouth of the creek to Centreville Landing, the head of navigation, is about 5 miles.

Town Bar, just inside the mouth of the creek, has on it a depth of nearly 8 feet at mean low water. There are two other shoals, respectively 3 and 3¾ miles above, and with the exception of these shoals a depth of 8 feet can be carried to within 6,000 feet of Centreville Landing.

There is a good shipping business done to and from the stream. At Centreville Landing there are good wharves and several large warehouses. The town of Centreville, in Queen Anne County, in the midst of a fertile and productive country, is about a mile from the landing. The cost of lighterage of grain and other products is a heavy tax on the community interested in the improvement.

To make a channel to the landing 100 feet wide, 8 feet deep at mean low water, with a turning basin of the same depth, 200 by 300 feet, would require the removal of 110,000 cubic yards of material, at a cost of $30,000.

The first appropriation for this locality was made August 2, 1882, $5,000. As it seemed but little benefit could be derived from the expenditure of this appropriation unless added to by another, it was deemed best to defer commencing at this locality.

In the summer of 1883 the increase of trade on the creek called renewed attention to it. A request was made for some dredging to facilitate the navigation. To determine what, if anything, could be advantageously done with the available funds required a careful resurvey of part of the stream. The results of this survey were not known at the close of the fiscal year. The officer in charge promises a special report should it seem necessary.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4 30
July 1, 1883, amount available	4,995 70
Amount (estimated) required for completion of existing project	25,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	25,000 00

(See Appendix H 5.)

6. *Chester River at Kent Island Narrows, Maryland.*—Nothing has been done at this locality since September, 1877. There has been an available balance of funds, but it has not been found necessary to expend it.

July 1, 1882, amount available	$2,500 00
July 1, 1883, amount available	2,500 00

(See Appendix H 6.)

7. *Harbor of Queenstown, Maryland.*—Nothing has been done at this locality in the year ending June 30, 1883.

(See Appendix H 7.)

8. *Improving Channel to Baltimore, Maryland.*—By nature the channel of approach to Baltimore had in it some places with not more than 16 or 17 feet at mean low water. This depth was increased at high water by 18 inches. The commerce of Baltimore was, therefore, of necessity, carried on in vessels of rather small size.

The project of improvement at first adopted, and commenced in October, 1853, had for its object to give a channel 22 feet deep at mean low water, with a width of 150 feet.

Little was done before the late war, but afterwards these dimensions were increased, a depth of 24 feet at mean low water being determined upon, with a width of channel ranging from 250 to 400 feet. This channel was completed in 1874, important changes of position having been given to a portion of it, by which the distance was materially lessened and the expense of maintenance decreased.

The object of this improvement was to permit the approach to Baltimore at mean low water of vessels drawing from 22½ to 23 feet, and at ordinary high water, of vessels drawing 24 and 24½ feet.

Up to June, 1882, the United States had expended $1,466,591.82, with the results indicated above. The city of Baltimore and the State of Maryland, chiefly the former, had contributed to the same object $584,000. Upon the call of Congress for information as to the cost of increasing the depth of the channel to 27 feet at mean low water, a report was made January, 1881. The estimated cost amounted to $1,250,000.

Congress sanctioned this step forward in the improvement in express terms in the river and harbor act of March 3, 1881, and appropriated $150,000 for commencing it. Soon thereafter a contract was entered into covering that appropriation and the previously existing balance of $200,000.

An appropriation of $450,000 was given August 2, 1882. As good progress as was wished was not made in 1882, but the work has gone forward with great rapidity in 1883, and it is believed that by the end of 1883 Baltimore will have a channel with 27 feet at mean low water. Besides this increase of depth from 24 to 27 feet at low water, the direction of the channel has been improved, its length shortened, and the cost of maintenance diminished. But the available funds will not suffice to give a proper width for easy navigation. The appropriation will be exhausted in 1883, and the work necessarily suspended, unless more money be provided in 1883, or very early in 1884.

July 1, 1882, amount available		$238,361 25
Amount appropriated by act passed August 2, 1882		450,000 00
		688,361 25
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$334,973 23	
July 1, 1883, outstanding liabilities	42,505 69	
		377,478 92
July 1, 1883, amount available		310,882 33
Amount (estimated) required for completion of existing project		450,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		450,000 00

(See Appendix H 8.)

9. *Harbor of Annapolis, Maryland.*—There are two bars, with not more than 18½ feet on them at mean low water, which prevent very large ships from passing into the deeper water (24 feet and more) of the Severn River, just abreast of the Naval Academy. The commerce of Annapolis is small. Its importance arises mainly from its being the seat of the Naval Academy, and from its strategic relations to the capital of the nation.

The project adopted for the improvement of the harbor and the entrance to it has been the excavation, by dredging, of a channel 24 feet deep at mean low water, with a minimum width of 150 feet. The rise of the tide is only about 1 foot.

The cost of this improvement has been estimated to be $66,000.

Two appropriations have been made, one of $5,000, June 14, 1880, the other, also of $5,000, March 3, 1881. As the expenditure of $10,000 would not effect any substantial improvement, it has been decided to await further action of Congress in this case.

If any additional appropriation be made, it should be for the balance required to complete the estimate for the channel 150 feet wide, 24 feet deep—$56,000.

July 1, 1882, amount available	$9,205 98
July 1, 1883, amount available	9,205 98
Amount (estimated) required for completion of existing project	56,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	56,000 00

(See Appendix H 9.)

10. *Choptank River, between Denton and Greensborough, Maryland.*—This portion of the Choptank River is about 8 miles in length, in Caroline County, on the eastern shore of Maryland, opposite Annapolis, on the western shore, and midway between Chesapeake and Delaware bays. About 9 or 10 feet of water (except at one point) can be found at mean low water as high as Denton, where the mean rise of tide is about 2 feet. The width at Denton is 200 feet, at Greensborough 160 feet, but is very variable between those two points, being in one place 650 feet.

The depth is also very variable. There are stretches with 8, 7, or 6 feet at low water, but there are numerous and extensive shoals with but 4, 3, or even 2 feet at mean low water. There is a bridge at Denton, and one 3½ or 4 miles below. These have draws in them about 50 feet wide.

The estimate submitted to Congress at the session of 1879–'80 was for an 8-foot low-water channel, 75 feet wide, $79,000. It was stated, however, that the cost would be much reduced if the depth was kept at 7 feet.

Congress appropriated 5,000 June 14, 1880. A re-examination of the river showed that a 6-foot low-water channel, 75 feet wide, from Passapee's landing to Gary's Wharf, near Greensborough, could be made for $40,000.

It was concluded to begin the dredging of such a channel. Proposals were called for by advertisement and a contract entered into for the work. Another appropriation of $5,000 was made March 3, 1881, which was also soon put under contract. Both appropriations were exhausted by November 7, 1881, a channel of 6 feet depth at mean low water being made available, of a width not less than 60 feet, up to a point within 3 miles of Greensborough. A steamer is now running regularly in this channel to and from Baltimore.

An appropriation of $5,000 was made August 2, 1882. Work was resumed as soon as a contractor could be had, in February, 1883, and

was concluded early in May, 1883. Instead of continuing the width of channel at 60 feet as below, it was concluded to make but one cut of the dredge. The resulting channel was thus only one-third of 60 feet, but it was carried up stream three times as far, and the depth was also kept down to 5 feet at low water. This smaller channel extends as high up as a point opposite "Cases." The navigation by grain-lighter is thus much facilitated.

Denton has about 500 or 600 inhabitants; Greensborough is a little larger. Both are thriving towns. The articles of shipment by the river are chiefly grain, lumber, and fruit, which occupy two lines of steamers to Baltimore from Denton and some small sailing vessels. It is expected that the improvement of the river to Greensborough would greatly increase the trade.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4,949 67
July 1, 1883, amount available	50 33
Amount (estimated) required for completion of existing project	25,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	10,000 00

(See Appendix H 10.)

11. *Secretary Creek, Maryland.*—There was nothing done at this locality in the year ending June 30, 1883.

(See Appendix H 11.)

12. *Harbor of Cambridge, Maryland.*—The town of Cambridge, the county seat of Dorchester County, is situated about 18 miles from the mouth of the Choptank River, on the eastern shore of the Chesapeake, about 70 miles from the city of Baltimore. Communication with Baltimore is maintained by two lines of steamboats. The town is also the terminus of the Dorchester and Delaware Railroad, which connects it with the railroad system of Delaware, and brings it into direct and speedy communication by rail with the principal cities of the Middle Atlantic region.

The original survey by the Engineer Department was made in October, 1870, which showed the harbor and the entrance to it from the Choptank River to be very shoal. The citizens of the place had previously endeavored to improve the harbor themselves, but they had not money enough, and what they did amounted to little in the way of permanent improvement.

The plan of improvement carried out by the Engineer Department has been to make a channel from the deep water of the Choptank to the railroad wharf in the inner harbor, and to increase the dimensions of that harbor, the outer channel to be not less than 100 feet wide, and the depth of all the dredging to be 8 feet at mean low water. The plan was completed in March, 1879. The amount expended up to June 30, 1880, was $29,801.90.

The last resurvey of the harbor and its approaches was made in March, 1880, when their condition was found to be good. The balance of former appropriations, $2,698.10, is held in reserve for expenditure when a necessity therefor may arise.

The Choptank is a fine river; 20 feet water can easily be carried for some distance above Cambridge. The town has considerable advantages for ship building, and has engaged to some extent in that business.

The western terminus of a favorable route for the proposed ship-canal

between Chesapeake and Delaware bays is on Ferry Creek, a tributary of the Choptank, very near Cambridge.

Some of the leading citizens of the town are desirous to have more enlargement of the harbor and its approaches. The necessity for this at the expense of the United States has not yet been made plain.

July 1, 1882, amount available	$2,687 70
July 1, 1883, amount available	2,687 70

(See Appendix H 12.)

13. *Treadhaven Creek, Maryland.*—Nothing has been done at this locality in the year ending June 30, 1883.

(See Appendix H 13.)

14. *Water passage between Deil's Island and Little Deil's Island, Maryland—(Lower Thoroughfare).*—Full report of the improvement at this place was made in the Annual Report for the year ending June 30, 1882. Nothing has been done in the year ending June 30, 1883.

July 1, 1882, amount available	$78 92
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	76 67
July 1, 1883, amount available	2 25

(See Appendix H 14.)

15. *Upper Thoroughfare between Deil's Island and the Mainland.*—This water passage separates Deil's Island from the mainland of Somerset County, Maryland.

What has been supposed to be needed in that vicinity was a harbor of refuge for small vessels, and to provide a place at which steamers could stop and bring the people and their abundant crops from the land and water into quick communication with the markets of Baltimore and Philadelphia.

In the river and harbor act of March 3, 1881, Congress made an appropriation of $5,000 for the Lower Thoroughfare, which is between Deil's and Little Deil's Island, about 3 miles from the Upper Thoroughfare. This appropriation was expended early in 1882 under a contract made in 1881. The main object was the same as at the Upper Thoroughfare, the making of a harbor of refuge.

An appropriation of $5,000 for the Upper Thoroughfare was made August 2, 1882. It was thought to be a better place for the harbor of refuge in that vicinity than the Lower Thoroughfare, and it was so stated in the reports, but Congress made an appropriation first for the lower and none for the upper until after work had been commenced and was well advanced on the lower. The necessity for another harbor of refuge so near that at the Lower Thoroughfare has not been perceived, and no work has yet been done in spending the appropriation of $5,000 at the Upper Thoroughfare.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	189 74
July 1, 1883, amount available	4,810 26
Amount (estimated) required for completion of existing project	15,000 00

(See Appendix H 15.)

16. *Broad Creek, Delaware, from its mouth to Laurel.*—The headwaters of this creek are near the Cypress Swamp, in Southern Delaware. It has a westerly course from Laurel, emptying into the Nanticoke about

5 miles above the forks and about 6 miles below Seaford, Del. Th distance from Laurel, the head of tide-water, to the mouth of the creek is about 7 miles.

From the mouth of the creek to Portsville, a landing about 4 miles below Laurel, there are not less than 10 feet at mean low water, and the rise of tide is about 3 feet. This depth is somewhat more than can be carried up the Nanticoke to the mouth of the creek. There is one point on the Nanticoke below where there are but 8½ or 9 feet at low water. There is but one other landing of any importance on the creek, Louisville, which is about a mile above Portsville. Louisville is the present head of navigation for vessels of any size; it is a small town of about 300 inhabitants; its principal business is repairing and fitting out vessels owned on and trading from the creek. Portsville is a small village with less than 100 inhabitants.

Broad Creek is crossed at Laurel by the railroad bridge, an ordinary trestle bridge without a draw, but with a span of 35 feet for the passage of lighters and small boats, having a clear height of 18 feet above the water. The county bridge, 1,600 feet above the railroad, is also a trestle bridge without a draw. There are no other bridges on the stream below Laurel.

From Portsville to about 1 mile above Louisville there is an available depth of 7 feet at mean low water, the channel in some places being not over 50 feet wide. In this portion the width of the creek varies from 150 to 275 feet, but there are several sharp changes of direction which are unfavorable for free navigation. The remainder of the creek, so far up as Laurel, was very shoal, before the improvement by the United States, the depth decreasing rapidly to 3, 2, 1, and ½ feet, and even less.

It was estimated by the officer in charge of the work that $46,500 would be required for dredging alone to make a channel 7 feet deep at mean low water and 60 feet wide, and this should be increased to $60,000, if regulation of the water-way were attempted by training walls. The sum of $5,000 having been appropriated June 14, 1880, it was decided to excavate a channel 20 feet wide, 4 feet deep at mean low water, extending from the railroad bridge at Laurel to a point below Big Mills, a distance of 5,373 feet, following the south side of the proposed deeper channel. The work was advertised, but the bids received were too high, and were rejected. The work was again advertised, with the same result.

A new appropriation of $10,000 was granted March 3, 1881. More money being thus available, it was decided to attempt to excavate a channel 32 feet wide, 6 feet deep at mean low water, from the bridge at Laurel, following the south side of the proposed channel for 6,500 feet.

This work having been placed under contract, was begun in October, 1881, and brought to a close in February, 1883. The result was a channel 32 feet wide and 6 feet deep at mean low water from the railroad bridge at Laurel to a point about 6,900 feet down the creek, and the natural channel below this point straightened and widened by cutting off some sharp points for a further distance of 4,300 feet.

A resurvey made in March, 1883, showed that a considerable filling in of the channel had taken place. It is no longer possible to carry 6 feet at low water to the head of the cut, and the 5-foot channel is narrowed to 25 feet in several places. At high water, this depth of 5 feet is increased to 8. It will be noticed the original report and estimate indicated the necessity of building regulating works. Money enough to build them was not provided. It does not seem expedient to dredge more in this creek unless such dikes be built.

The appended estimate (which is explained in full in the report of the

officer in charge, and is to be found in the appendix to this report) is for the building of the dikes and the restoration by dredging of the 6 feet depth, in a channel about 50 feet wide. The stream is not large enough to justify a greater width.

July 1, 1882, amount available	$6,170 17
Amount appropriated by act passed August 2, 1882	5,000 00
	11,170 17
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	11,170 17
Amount (estimated) required for completion of existing project	32,625 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	20,000 00

(See Appendix H 16.)

17. *Wicomico River, Maryland.*—The natural channel of this river, for some distance below the town of Salisbury, was quite crooked and narrow, and at the shoalest places did not afford more than a few inches of water at low-tide. Much injury had also been done by the saw-mills pouring their dust into it. A considerable portion of the shoals was found to be composed of water-soaked sawdust mixed with mud and sand. It should be stated here that this supply of sawdust to the river has, for several years, been entirely cut off.

The project for improving this river was adopted in 1871, and had in view giving a depth of 7 feet at mean low water in a channel about 70 feet wide for a distance of about 2 miles below the bridge at Salisbury. The project also included some dikes for the contraction of the waterway and as a place behind which to deposit material dredged from the channel.

At the end of June, 1882, the amount expended had been $38,493.92, and a channel 65 feet in width, 7 feet deep at mean low water, had been carried to the bridge. A good turning-basin had also been excavated near the town in both forks of the river.

No appropriation has been made since one of $2,000 in March, 1881, of which a balance remains available. In the appropriation act of August 2, 1882, Congress directed a preliminary examination of the Wicomico from Salisbury to its mouth. This was made in October, 1882.

While the condition of the dredged channel has continued good, some little dredging was found necessary in June.

July 1, 1882, amount available	$1,508 41
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	123 03
July 1, 1883, amount available	1,385 38

(See Appendix H 17.)

18. *Pocomoke River, Maryland.*—No work has been done on this river since April, 1880. What was accomplished was fully set forth in the Annual Reports for 1879 and 1880.

Congress directed in the act of August 2, 1882, that an examination of the river be made with a view to a cut-off in the bend just below Snow Hill. The examination was completed in October. It thence appeared that no detailed survey was necessary, as the information obtained from the examination was sufficient.

(See Appendix H 18.)

19. *Onancock Harbor, Virginia.*—Operations at this place were closed in April, 1881, according to the plan fully explained in the Annual Re-

port for year ending June 30, 1881. Nothing was done in the year ending June 30, 1883.

(See Appendix H 19.)

20. *James River, Virginia.*—Previous to 1870 the first 4 miles below Richmond were shallow except in short reaches, the general depth being 8½ feet in channel at low-tide. The reef at Rocketts and the sand shoal known as Richmond Bar had but 7 feet. Warwick Bar, 5 miles below the city, had 13 feet. The channel below Richmond was tortuous and obstructed with a large number of rocks, mostly bowlders, besides the ledges at Rocketts and Goode's. Many vessels, sunk during the war of 1861–'65, especially at Drury's Bluff, were very serious obstructions. The Dutch Gap Cut-off, which now saves 5½ miles of difficult navigation, was not open. After the flood of 1870 but little over 6½ feet could be carried over Richmond Bar at low-tide.

The original project for improvement was for 18 feet at high-tide, with a channel width of 180 feet from the Richmond Dock to below Harrison's Bar. The mean rise and fall of tide is about 3½ feet, and the excavations in rock were to be carried to 15 feet at low water. In removing sand-shoals, where the operation is aided by wing-dams, the intention has been to so contract that the scour would produce a channel of the same depth. The only intentional change in plan has been to make the channel below Warwick Bar, 5 miles below Richmond, 200 feet by 18 at low-tide instead of high-tide.

The amount expended by the United States to June 30, 1882, was $585,638.18, and by the city of Richmond about $387,500. At that date, at high-water of spring tides, the channel afforded the following depths: 20 feet from the sea to City Point, 19 feet thence to Warwick Bar, and of 17 feet from the latter point to wharves at Rocketts, though the depths of ordinary high water were less. The method of improvement from the beginning, which has been adhered to, has consisted mainly in removing the sand and mud bars by dredging and contracting the width of the river adjacent by wing-dams and training-walls for the maintenance of the depth, and in removing bowlders and rock in beds by drilling and blasting. Under the pressure of the demands of commerce for immediate results much money has been spent on this and other rivers in quickly giving depth and width of channel by dredging when it was well foreseen that permanence could only be expected through the aid of contracting works, for which there had been not sufficient funds available. Thus the same bars have been dredged over and over again.

The amount expended in the year ending June 30, 1883, by the United States, has been $7,252.54, and by the city of Richmond, about $7,000.

At the close of the last fiscal year active operations had been suspended and have not yet been resumed. The river and harbor act of August 2, 1882, appropriated $75,000. Advertisement was made for letting a quantity of dredging, rock excavation, and dike work, but without success, as it was deemed judicious to reject the only bid received. Trial was afterward made to organize for a quantity of work to be performed by hired labor, a dredge to be obtained by contract, advertisement being made. This project was unsuccessful, as the two bids received, to furnish dredge for work by the hour, were unsatisfactory. Although no work of improvement was done during the year the indications of several examinations made are that the condition of the river has remained sensibly the same, and that a small sum would repair all injury to the works.

From the data furnished by surveys, taken in connection with previous experience and estimates, the cost of completing the present project is $525,000. Of this amount $150,000 could be profitably expended in the fiscal year ending June 30, 1885. This sum, or so much thereof as may be appropriated, should be applied to widening and deepening the channel in the hard material near Richmond, in the further improvement below to include Kingsland Reach, and to the maintenance of the depths now obtained.

The permanence of the improvement through shoals of alluvium can only be maintained by permanently contracting the river at these points. The contraction has heretofore been made for the most part with timber structures, which are not permanent. These structures are being revetted with material dredged from the river, much of which is suitable for that purpose and permanent, but a larger amount than is likely to come from the river under the present scheme will be required to permanently protect the wing-dams already built.

As directed by Congress, a survey was made to determine the practicability and cost of procuring a channel 25 feet deep at full tide from Richmond to the mouth of the river. A report was rendered and printed as Senate Ex. Doc. No. 147, Forty-seventh Congress, first session, and printed in the Annual Report of the Chief of Engineers for 1882, Part I, page 870. This survey demonstrated the practicability of the project, and from the data obtained the cost thereof was estimated at $4,500,000, the width in artificial channels from the sea to City Point being 400 feet, from City Point to Drewry's Bluff 300 feet, and from Drewry's Bluff to Richmond 200 feet. Estimates were made for two other projects, denominated in the report *second project* and *third project*, that for the *second project* being $2,100,000, and that for the *third project* being $2,500,000. In the report these projects are fully described.

If this further deepening be undertaken the lines of contraction should be brought nearer together, and the permanent work on any training-walls parallel to the current built under the present plan would in great measure be lost. It may also be that the repairs to timber dikes from time to time may be less than the interest on permanent work.

As stated above, but little work has been done during the year ending June 30, 1883. For this there has been a double reason. The condition of the river, though not entirely satisfactory, has been quite permanent, and has seemed to suffice for the absolute requirements of navigation. In the state of uncertainty whether Congress intends to authorize a change of project from a depth of 15 to 22 feet at low water, it has not seemed judicious to do much work on the small project, as some of it would be not only useless but injurious in the larger. It is hoped the opinion of Congress may be plainly set forth in the next appropriation for this river.

The figures in the money statement below refer to the smaller project. Should Congress approve the larger the appropriation should be at least twice as large to insure good results.

July 1, 1882, amount available	$4,361 82
Amount appropriated by act passed August 2, 1882	75,000 00
	79,361 82
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	7,252 54
July 1, 1883, amount available	72,109 28
Amount (estimated) required for completion of existing project	525,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	150,000 00

(See Appendix H 20.)

21. *Appomattox River, Virginia.*—At the close of the war the navigation of this river was in such a condition that the depth of water on more than one of the shoals did not exceed 6½ feet at high-tide, and this depth was diminished by 3 feet at low-tide. The plan of improvement adopted in 1870 was to attain a depth of 12 feet at high water, with as much width of channel as the river would bear.

The channel from Petersburg to the deep water below is naturally divided into three parts. In the lowest division, called the South Channel, which is a natural channel, dredging alone has been resorted to until now, when some contracting works have been commenced. Recent examination shows a marked improvement in this channel; that portion having less than 12 feet at high-tide being now about 1,000 feet in length.

The next division above the South Channel, called the Puddledock Channel, is altogether an artificial cut through a swamp. In 1876 this cut had been made 100 feet wide, with embankments on the sides planted with willows. At the head of this cut the river was turned entirely from the original channel and passed through the new cut. In the year 1881–'82 this cut was somewhat widened on the high-water level, and its capacity for freshet discharge thus increased.

The division of the channel from the Puddledock Cut to the city is called the Petersburg Channel. It has been for several years in process of improvement by the use of wing-dams and training-walls, the channel to be about 100 feet in width. The system is yet incomplete.

To maintain the channel dredged in the harbor of Petersburg in 1881 there have been built ten new timber wing-dams; at Magazine Bend three timber and seven wattled wing-dams have been built and repairs to the works have been made generally throughout this division, especially to the closure dike and the adjacent structures where breaks of considerable extent were repaired and a large amount of mat and gravel protection placed.

The city of Petersburg has nearly completed the construction of a new dredge which will undoubtedly be of much benefit to the port.

The late examinations show generally a gradual improvement in the depth of the navigable channel except at Magazine Bend, where the material scoured out by the influence of the contracting works above was deposited. This material would eventually be carried still further down and to deeper water, but it is the intention to remove it this season. At this point a channel depth of 10 feet is available at mean high-tide; a short distance above the closure dike 11.8 feet is available; at the head of Puddledock Cut 10½ feet is available, and in the South Channel 11.7 feet, all at mean high-tide.

The amount expended in the year ending June 30, 1883, was $13,373. The total amount expended by the United States in the execution of the adopted project has been $334,612.13.

July 1, 1882, amount available	$852	41
Amount appropriated by act passed August 2, 1882	35,000	00
	35,852	41
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	13,373	00
July 1, 1883, amount available	22,479	41
Amount (estimated) required for completion of existing project	70,800	00
Amount that can be profitably expended in fiscal year ending June 30, 1885	70,800	00

(See Appendix H 21.)

22. *Shenandoah River, West Virginia.*—Nothing has been done on this river since the last Annual Report. Two appropriations have been

made, one of $15,000, June 14, 1880, and one of $2,500, March 3, 1881. The last had a proviso that neither should be expended "until any corporate rights or franchises that may exist on said river shall have been relinquished to the United States to the satisfaction of the Secretary of War."

After considerable delay an opinion was given in June, 1883, by the United States district attorney for West Virginia that the conditions imposed by Congress had been satisfied. Should the Secretary of War approve, the work could be commenced.

July 1, 1882, amount available	$17,312 20
July 1, 1883, amount available	17,312 20
Amount (estimated) required for completion of existing project	7,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	7,500 00

(See Appendix H 22.)

23. *New River, from the mouth of Wilson, in Grayson County, Virginia, to the mouth of Greenbrier River, in West Virginia.*—As has been stated in previous reports, but is here repeated to save trouble in referring to other volumes, the appropriations have been made in such a manner as to divide this portion of the river into three sections, as follows:

	Miles.
Upper or Lead mines	62
Middle or New River Bridge	43
Lower or Greenbrier	86½

Throughout this distance the navigable channel originally consisted of natural chutes, through the ledges and shoals, of varying widths, rarely over 1 foot in depth, in some places so tortuous as to render navigation extremely difficult and dangerous.

The original project adopted for the improvement of these natural channels was to widen them to 30 or 50 feet, as might be required, deepen them to 2 feet, and straighten such as needed it. This was for bateau navigation, the improvement, however, to be made in such a manner as to aid the work should a greater depth and width be required in the future.

A small steamboat, draught 12 inches, when light, having been built at Hinton in the fall of 1878, rendered it necessary to make the channel, in that section, 50 feet wide at all points, and in many from 75 feet to 100 feet, the depth of 2 feet being retained. This steamboat was not adapted in dimensions and power to the navigation of the river, and has been withdrawn.

The original plan of improvement has been adhered to, except that the width of channels on the middle and upper divisions has been reduced to 20 feet, and on the former to 10 feet for several miles, to allow iron to be shipped from the furnaces above.

Most of the work of 1882, on the Greenbrier Division, was done at Wiley's Falls, in reducing the grade from 1.95 feet in 100 to 72. The length of navigable channel above Hinton on this division is the same, 26½ miles, as reported a year ago, but it has been much improved.

June 30, 1882, there was a channel from New River Bridge to the head of Jones's Ford, a distance of 22 miles, 2 feet deep, 30 feet wide for 12 miles, 20 feet wide for 2½ miles, and 10 feet wide for 7½ miles. During the season of 1882 this channel was extended through 7¼ miles, with a width of 10 feet and a depth of 2 feet to a point 29¼ miles above the bridge.

Nothing was done during the fiscal year on the Lead Mines Division, as it is separated from the remainder of the river by Foster's Falls, which are not passable.

Nothing was done in 1883 before the end of the fiscal year on the

whole river. When work ceased in October, 1882, the property pertaining to each divsion was placed in store, as usual, in charge of a watchman. The assistant engineer was then brought to Baltimore and employed in preparing his report of past work, making drawings showing the condition of the river at the close of the operations of the season, and the progress of the improvement, with estimates of the cost of what yet remains to be done for its completion.

When Congress adjourned March 3, 1883, without provision for further work, it was deemed best and most economical, instead of keeping the property in store at considerable expense for a long time, to collect it at some convenient place and dispose of it. Hinton was the point selected. The day of sale was April 25, 1883, and the amount realized $415.16, which was turned into the Treasury in conformity to law. The assistant engineer was, with regret, discharged at the end of May. His services have been of much value.

It has hardly been practicable to accomplish at any one of the very many points needing improvement all that has been desirable, but the worst places have been worked upon to the greatest extent and efforts thus been made to increase the available navigability of the river over as long stretches as possible, and to increase the facilities for access of the greatest number to the railroads touching the river, and thus connecting with the eastern and western markets districts otherwise much isolated and hitherto dependent on teaming to railroad stations over long and bad roads.

Should work be resumed, it will be found difficult to collect and organize as efficient a force as that which has been disbanded and necessarily scattered. To replace such a machine takes time and money.

The number of large boats on the river for carrying freight has increased to twenty-five. The following important facts are taken from the report of the superintending engineer:

Of the freight sent from Hinton in 1882, 95 per cent. came from New River, an increase over 1881 of 46 per cent.

Of the freight received at Hinton in 1882, 43 per cent. went up the river; 24½ per cent. increase on shipments from Hinton in 1882 over 1881; 9 per cent. increase on freight received at Hinton in 1882 over 1881.

In the same order as above, the percentages at Lowell and Hinton Stations, Chesapeake and Ohio Railway combined, were respectively 92½, 46, 14, and 55.

The shipments from the various stations on the Norfolk and Western Railroad, tributary to the river, were not received from the auditor, owing to want of time to prepare them, which is much to be regretted, as it is desirable to have comparisons annually.

The navigation of the river not being continuous as yet, it is practically a feeder to the railroads which cross it and run along portions of it. It has also been of much use in carrying materials and supplies to the railroads while in process of construction near it. It is probable that when the river is fully improved boats will transport one-third of the products of the fine agricultural country through which it flows, and seven-eighths of those of the mines, exclusive of coal.

July 1, 1882, amount available		$3,506 10
Amount appropriated by act passed August 2, 1882		12,000 00
		15,506 10
July 1, 1883, amount expended during fiscal year exclusive of outstanding liabilities July 1, 1882		12,419 44
July 1, 1883, amount available		3,086 66
Amount (estimated) required for completion of existing project		169,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		50,000 00

(See Appendix H 23.)

24. *Great Kanawha River, West Virginia.*—This river flows through a fertile and picturesque region, filled also with mineral wealth, especially coal and salt. It was by nature divided into a number of pools, some of considerable length and depth, separated by shoals of gravel and coarse sand, which were the principal obstructions to navigation in low water, there being often on them at such seasons but a few inches of water. In some of the pools were found shallow places also obstructing navigation. There were also snags and loose rock in the channel. The navigation above Charleston was more obstructed than below. Above, it was almost suspended in summer. The coal and salt were generally sent out on rises, which enabled the boats to pass safely over the obstructions which otherwise would stop their movements entirely. The use of the river for the movement of these valuable products was therefore unsatisfactory and intermittent. By the agency and superintendence of a board acting under the authority of the state, first of Virginia and then of West Virginia, considerable improvement in the river was from time to time effected, tolls being charged on the commerce for payment of expenses.

The object of the improvement begun several years ago by the United States was to give a constant navigable depth of at least 6 feet throughout the whole length of the Kanawha to its mouth at the Ohio River, to be accomplished by large locks and dams. Those already built have been about 350 by 50 feet. The peculiarity of most of the dams is that they can be lowered when the stage of water in the river will suffice over the shoals. This gives them the name of "movable dams," and enables an open river to be had when the water is high enough.

Dams 3 and 2, both above Paint Creek, are fixed, as the declivity of the river in that section is too great to permit the advantageous use of the movable system. Dam 1 would also be fixed if constructed, but it will probably not be necessary to build that dam for many years, if ever.

Up to June 30, 1882, the amount expended had been $1,202,790.04. At that date Lock and Dam 3, 2½ miles above Charleston Ferry, had lately been completed. Locks and Dams 4 and 5, respectively, 9⅛ and 15¼ miles above Charleston Ferry, were finished and in successful operation. Lock 6, 4 miles below Charleston Ferry, was under contract and well advanced towards completion. Site 7, 14 miles below Charleston, had been procured by the United States. Negotiations were in progress for the procurement of Site 2, a mile below Cannelton and 26½ miles above Charleston. These negotiations have been unusually tedious.

The amount expended in the year ending June 30, 1883, was $124,683.46, which has been applied to the acquisition of Site 2, operating Locks 3, 4, and 5, and Dams 4 and 5, carrying Lock 6 nearly to completion, and incidental expenses. A contract has been made for as much of Lock 2 as was practicable with the funds available. It is very desirable to complete Locks 2 and 6 without delay, as also their dams. The next step would be the beginning of Lock and Dam 7, the site for which already belongs to the United States.

July 1, 1882, amount available		$135,209 96
Amount appropriated by act passed August 2, 1882		200,000 00
		335,209 96
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$107,479 91	
July 1, 1883, outstanding liabilities	17,203 55	
		124,683 46
July 1, 1883, amount available		210,526 50

Amount (estimated) required for completion of existing project	$2,050,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	350,000 00

(See Appendix H 24.)

25. *Elk River, West Virginia.*—There was a small balance available from former appropriations, to which was added the sum of $2,000 in the act of August 2, 1882. As the season for operations on the river had nearly passed at that date, as well as because the remains of the lock and dam built near its mouth under charter from the State form a hurtful and serious obstruction to navigation, the superintending engineer recommended a suspension of work in the hope that the company or individuals owning the lock and dam would give relief to navigation by removing the *débris*. Nothing has been done by those owners, and work on the river has not been resumed.

July 1, 1882, amount available	$973,90
Amount appropriated by act passed August 2, 1882	2,000 00
	2,973 90
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	10 00
July 1, 1883, amount available	2,963 00

(See Appendix H 25.)

26. *Cape Fear River, North Carolina.*—A detailed account of the history of this improvement for many years past, and of the condition ot the navigation was given in the Annual Report for 1881, Part I, page 148.

The amount expended up to June 30, 1882, was $1,214,469.26. The depth on the bar of the Baldhead Channel was 14 feet at mean low water. The least depth on the Horseshoe Shoal was 11 feet, and thence to Wilmington the least depth was 12 feet, but the channel was in a few places quite narrow. Vessels drawing 14½ feet of water could at ordinary spring-tides be carried from Wilmington to Smithville, and 18 feet draught thence to the ocean.

The amount expended in the year ending June 30, 1883, has been $119,638.22, which has been chiefly applied to continued dredging in the new channel along and above Snow's Marsh from the deep water of the harbor of Smithville to deep water in the old channel about 1½ miles above Federal Point. After nearly two years' work on the cut it is now nearly finished to 270 feet width and 16 feet depth at mean low water. The early completion of this channel to the city of Wilmington is highly important for the interests of commerce and navigation.

The New Inlet Dam remains as finished two years ago. Its permanence would seem to be beyond doubt. It is important that the United States should have complete ownership or control of the land at both ends of the dam, and across the low lands of Federal Point and Zeke's and Smith's islands to the high lands at Fort Fisher and the mainland of Smith's Island. At extraordinary storms and tides these sandy lands and beaches are swashed across by the tide and waves, and then there is a liability for breaches which might ultimately become inlets and jeopardize the value of the costly works completed. But having perfect control of the premises, a small expenditure would thoroughly avert any danger. This matter is suggested by the fact that the claimant of Federal Point has begun a suit in ejectment against the assistant engineer on account of the governmental occupation of the place, in the prosecution of the work, for quarters of employés, storage of materials, &c. It is recommended that Congress authorize the procurement of the lands mentioned above by condemnation under the laws of North Carolina, if applicable, the expense thereof to be paid from the next appro-

priation for the improvement of the river. It may be safely affirmed that these lands had little or no value before the improvement of the river by the United States, and have very little now to any other than the United States.

The continued recession of the long, narrow beach of Smith's Island and the apparently greater persistence of the "swashes" or shallow openings through it, since the closing of New Inlet, seem to point to the danger of another hurtful connection between the river and the ocean, such as New Inlet was for nearly a century. It is better to check this tendency now when it may be done at comparatively small expense by an interior work nearly parallel with a portion of Smith's Island. The cost of this has been estimated by the local engineer.

July 1, 1882, amount available		$63,030 74
Amount appropriated by act passed August 2, 1882		225,000 00
		288,030 74
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities, July 1, 1882	$108,746 92	
July 1, 1883, outstanding liabilities	10,891 30	
		119,638 22
July 1, 1883, amount available		168,392 52
Amount (estimated) required for completion of existing project		482,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		300,000 00

(See Appendix H 26.)

27. *Removing sunken vessels obstructing or endangering navigation.*—Several cases of this kind have been reported to the Secretary of War under the provisions of section 4, act of June 14, 1880, amended by act of August 2, 1882.

February, 1883, Mr. James Bates complained that the navigation of Middle River, near Baltimore, Md., was obstructed by the wreck of a small vessel called the Grey Eagle. It was found upon examination not to require the action of the United States.

The wrecks of the Clara S. and the Cascatelle were represented in March, 1883, as endangering the navigation of the lower Chesapeake Bay. The Clara S. was afterwards taken up by the Baker Salvage Company of Norfolk, Va., without expense to the United States. The Cascatelle appearing to have been abandoned by her owners, proposals for her removal were called for under the authority of the War Department.

Complaint was made in June, 1883, that the wreck of the barkentine Wolverton was an obstruction to the navigation of Chincoteague Bay, Maryland, and the owners being informed she would be removed by the United States, unless they did the work themselves, they arranged to have it done.

(See Appendix H 27.)

28. *Surveys for a ship-canal to connect Chesapeake and Delaware bays.*—The act of August 2, 1882, contained the following clause:

> That the sum of $10,000, or so much thereof as may be necessary, be, and the same is hereby appropriated to be expended under the direction of the Secretary of War, in completing the surveys of a ship-canal to connect the Chesapeake and Delaware bays; and the Secretary of War is hereby directed to report to Congress which of the various routes surveyed will afford the greatest protection in case of war, and the greatest facilities to commerce by cheapening the cost of transportation from the city of Baltimore to the Atlantic Ocean, together with the cost of said improvement and its approaches, and the annual cost of maintaining and operating said canal when constructed: *Provided*, that nothing herein shall be construed to commit the Government to proceed with the construction of the said improvement.

For a report of the officer in charge, see Appendix H 28.

IMPROVEMENT OF THE HARBORS AT WASHINGTON AND GEORGETOWN, DISTRICT OF COLUMBIA. IMPROVEMENT OF THE POTOMAC RIVER IN THE VICINITY OF WASHINGTON, DISTRICT OF COLUMBIA.

Officer in charge, Maj. Peter C. Hains, Corps of Engineers.

1. *Harbors at Washington and Georgetown, District of Columbia.* (In charge of Mr. S. T. Abert, United States Civil Engineer, to September, 1882.)—The improvement of the navigation of Washington and Georgetown harbors was first undertaken by the corporation of Georgetown, D. C. A dredge was maintained at this work by the corporation for a number of years.

In 1833 an appropriation was made by the United States to enable the citizens of Georgetown "to remove the obstructions to their navigation, by causing the cut already made through the bar below the town to be enlarged and deepened, and for other purposes." Of this appropriation the sum of $48,266.60 was expended in excavating a channel through the bars above and below Long Bridge.

The first regular appropriation by the United States for the improvement of the harbors of Washington and Georgetown was made in 1870. The project then adopted had in view the securing and maintaining of a navigable channel from Easby's Point, in the city of Washington, D. C., to Giesboro' Point, D. C., 200 feet wide and 16 feet deep at mean low-tide; the removal of rocks in Georgetown Harbor, and to securing and maintaining to the wharves in Georgetown a channel of the dimensions requisite for navigation.

Previous to this time, the natural channel over the bar below Georgetown was only 8 feet at mean low-tide.

The amount expended to June 30, 1882, was	$234,364 06
Expended during the fiscal year June 30, 1883	11,927 80
Total expenditure to June 30, 1883	246,291 86

These expenditures have resulted in securing in the approaches to Georgetown a navigable channel from 15 to 17 feet deep and 200 feet wide; and a channel to the wharves along the Washington front 15 to 16 feet deep and 190 feet wide.

The improvements now in progress under the appropriation for filling the Potomac Flats will give a navigable channel up to Georgetown of 20 feet at low-tide.

There is available for the improvement of the harbors of Washington and Georgetown the sum of $45,693.79. Of this amount it is proposed to apply $41,275.09 to the removal of rocks that obstruct navigation in Georgetown Harbor, reserving $4,418.70 available for Washington Harbor for such contingencies as may arise.

There are other rocks in Georgetown Harbor that are an obstacle to navigation, and will become a more serious obstruction when vessels of deeper draught seek this port for freight. To remove them will require an additional appropriation of $60,000.

The officer in charge calls attention to the advisability of removing the damaged causeway between Analostan Island and the Virginia shore, and replacing it by a dam, reaching to the level of high water, with a view to keeping all the water of the river in the Georgetown channel during its ordinary stages, and in times of freshets providing an additional outlet.

July 1, 1882, amount available		$57,621 59
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$11,154 53	
July 1, 1883, outstanding liabilities	773 27	
		11,927 80
July 1, 1883, amount available		45,693 79
Amount (estimated) required for completion of existing project		60,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		60,000 00

(See Appendix I 1.)

2. *Improvement of the Potomac River in the vicinity of Washington, District of Columbia.*—The present project for the improvement of the Potomac River in the vicinity of Washington, D. C., was adopted by act of Congress August 2, 1882, wherein it is enacted that the sum of $400,000 is appropriated for "improving the Potomac River in the vicinity of Washington with reference to the improvement of navigation, the establishment of harbor-lines, and the raising of the flats, under the direction of the Secretary of War, and in accordance with the plan and report made in compliance with the river and harbor act, approved March 3, 1881, and the reports of the Board of Engineers made in compliance with the resolution of the Senate of December 13, 1881."

The object of the improvement is to secure a depth of water up as far as Georgetown as great as will accommodate the largest class of vessels that can reach Giesboro' Point, to establish the harbor-lines, beyond which obstructions, such as wharves, &c., should not be built, and at the same time fill up the flats or marshes in front of the city of Washington, raising them above the highest freshets, thereby improving its sanitary condition. The material taken from the river in improving the navigation to be used as far as may be in filling up the flats.

The expenditures under this appropriation have thus far resulted in opening a partially-completed channel 20 feet deep at low-tide, which is to be made 400 feet wide; in covering not less than about 30 acres of marsh land with the material taken from the channel, reclaiming that area from overflow; and in getting proper plant and machinery on the work for its future prosecution.

The amount of land reclaimed thus far represents but a small fraction of the actual outlay made to get the work started.

About 10,000 linear feet of railway with steel rails has been built on the flats, stocked with two 18-ton locomotives and forty cars of 10 cubic yards capacity each. Five dredges have been put on the work; four of them are new ones of the most approved pattern and of large capacity; others are to be added.

The work up to the present time has not progressed as rapidly as was expected, owing to delays attending the use of new machinery and from other causes, but it is now in a condition favorable for rapid prosecution.

The foundation for about 3,000 feet of slope-wall has been built, and about 4,000 more partially so.

The amount available for the fiscal year ending June 30, 1884, is $346,590.17, all of which is needed to meet liabilities already contracted for. There is practically nothing available for commencing additional work, which could be done if funds were available for the purpose.

With the money now available it is proposed to complete a channel somewhat less than 400 feet wide and 20 feet deep from Georgetown to Giesboro' Point, fill about 140 acres of the flats, build about 7,000 linear

feet of embankment, 50 feet wide on top, along the line of the outer edge of the fill, and face it with a protection of rip-rap.

The estimated cost of the work, according to the existing project, is $2,716,509. This does not include the cost of building retaining walls to the sewer-canal at the foot of Seventeenth street. Provision should be made for the construction of these walls at the earliest day practicable, as the work of filling the flats in the immediate vicinity of the sewer-canal cannot be properly executed until they are built.

The canal will be about 3,400 feet long. The walls should be built on a pile and grillage foundation to a height of 6 feet above mean low-tide. It is proposed to discharge about 10,000,000 gallons of fresh water from the lakes into the canal on the latter part of each ebb-tide, a quantity sufficient to change the water throughout the entire length of the canal each day.

The officer in charge of the improvement recommends building the walls of concrete. The estimated cost is $208,144. At least $1,000,000 could be profitably expended during the fiscal year ending June 30, 1885, for continuing the improvement in accordance with the existing project, including the building of inlet and outlet sluice-gates. This is in addition to the amount required for building walls to the sewer-canal.

Under the provisions of the act of Congress of June 21, 1870, giving the possession of the Long Bridge to the Baltimore and Potomac Railroad Company, it was enacted that the United States should have the right to alter or amend the law.

It is of the utmost importance that the causeway at the south end of the Long Bridge be removed, and that the bridge be carried on trestle or piers for a distance of 400 to 500 feet, in order that a portion of Alexander's Island may be cut off to a depth of about 6 feet. If this causeway should remain as it now is and the Washington channel be closed, the sectional area of the river will be too small at the bridge to discharge the flood-waters in times of freshets, in conseqnence of which damage may result to private property, as well as the bridge itself. If the flood-waters of the Washington Channel be added to that of the Georgetown Channel, the capacity of the latter must be increased.

The officer in charge of this improvement suggests that Congress so amend the law as to require the causeway at the south end of the Long Bridge to be removed, and the bridge extended on trestles or piers for a distance of not less than 400 feet. A new bridge will be necessary at no distant day, but with the causeway on Alexander's Island removed, the present one will serve its purposes until the flats are filled in and it is decided that disposition is to be made of the land reclaimed.

Amount appropriated by act passed August 2, 1882		$400,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$49,186 86	
July 1, 1883, outstanding liabilities	4,222 97	
		53,409 83
July 1, 1883, amount available		346,590 17
Amount (estimated) required for completion of existing project		2,316,365 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		1,000,000 00

(See Appendix I 2.)

IMPROVEMENT OF THE HARBORS AT BRETON BAY AND SAINT JEROME'S CREEK, MARYLAND; OF THE CHANNEL AT MOUNT VERNON, VIRGINIA; OF RAPPAHANNOCK RIVER; OF TRIBUTARIES OF THE LOWER POTOMAC, AND OF CERTAIN RIVERS IN VIRGINIA AND NORTH CAROLINA.

Engineer in charge, Mr. S. T. Abert, United States Civil Engineer.

1. *Channel at Mount Vernon, Virginia.*—Previous to the commencement of this improvement, there was a depth of but 4 feet at low water over the wide flat between the wharf at Mount Vernon and the main channel of the Potomac River.

The present project for the improvement of this channel was adopted in 1879, the object being to excavate a channel from deep water at Mount Vernon 150 feet wide, and from 6 to 7 feet deep at low water, with a turning-basin at the wharf.

The amount expended thereon to the end of the fiscal year ending June 30, 1882, was $8,442.68, which resulted in securing a channel 145 feet wide, with a depth varying from 7 to 9 feet from the Potomac Channel to the wharf, and a circular turning-basin at the wharf of the same depth and with a radius of 150 feet.

The appropriation of $5,500 asked for is to be applied to widening the channel and enlarging the turning-basin, and will complete the proposed plan of improvement.

July 1, 1882, amount available	$57 14
July 1, 1883, amount available	57 14
Amount (estimated) required for completion of existing project	5,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	5,500 00

(See Appendix J 1.)

2. *Neabsco Creek, Virginia.*—The obstruction to navigation in this stream consisted of a wide flat at the mouth, about 1½ miles in length, over which but 2¼ feet could be carried at low water, and several short bars in the upper part of the creek, where the channel is narrow and tortuous.

The present project for the improvement was adopted in 1881, and contemplated the excavation of a channel through the bars 100 feet wide and 7 feet deep at low water from the Potomac River to Atkinson's Upper Landing (including a channel to Atkinson's Lower Landing and Willis's Wharf), a distance of about 14,800 feet.

The amount expended to the close of the fiscal year ending June 30, 1883, was $4,711.33, and has resulted in securing a channel 50 feet wide and from 4 to 5 feet deep at low water from the Potomac River to a point 1,800 feet above Willis's Wharf, where the creek is narrow and has a sufficient depth, although other bars still exist above this point.

For continuing the improvement an appropriation of $20,000 is recommended for the year ending June 30, 1885.

July 1, 1882, amount available	$286 67
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	229 40
July 1, 1883, amount available	57 27
Amount (estimated) required for completion of existing project	51,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	20,000 00

(See Appendix J 2.)

3. *Breton Bay, Leonardtown, Maryland.*—The harbor of Leonardtown, at the upper end of Breton Bay, prior to the commencement of the

present improvement, had a least depth of only 5 feet at low water, which was insufficient for the passage of steamers to and from the Leonardtown Wharf.

The present project for the improvement was adopted in 1878, the object being to excavate a channel 150 feet wide and 9 feet deep between the 9-foot curve in the bay and Leonardtown Wharf.

The amount expended to June 30, 1882, was $14,996.05. During the fiscal year ending June 30, 1883, $4,987.99 have been expended, making a total to June 30, 1883, of $19,984.04.

These expenditures have resulted in securing a channel 115 feet wide for a distance of 2,700 feet and 120 feet wide on curve for a distance of 1,000 feet, with a basin at the wharf 285 feet wide for a distance of 340 feet, then contracting gradually to 115 feet width, where it joins the steamboat channel, all to a depth of 9 to 10 feet at low water.

The appropriation of $10,000 asked for will complete this improvement, and will be applied to widening the channel.

July 1, 1882, amount available	$3 95
Amount appropriated by act passed August 2, 1882	5,000 00
	5,003 95
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4,987 99
July 1, 1883, amount available	15 96
Amount (estimated) required for completion of existing project	10,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	10,000 00

(See Appendix J 3.)

4. *Nomini Creek, Virginia.*—The first surveys at Nomini Creek were made in 1873. The stream is an important tributary of the Potomac, 82 miles below Washington, draining a large area of productive country. The navigation was, however, obstructed by a bar of sand and oyster shells at its mouth, over which but 3 feet could be carried at low water, and the dangers and difficulties in passing the bar were further increased by the cross-tides and an exceedingly rapid current.

The present project for the improvement was adopted in 1873, the object being to excavate a channel through this bar 100 feet wide and 9 feet deep at low water, and was modified in 1879 so as to provide for a width of 150 feet.

The amount expended to June 30, 1882, was $30,500. This resulted in securing a channel from 9 to 10 feet deep at low water, with a width varying from 105 to 160 feet, the latter width having been dredged at White Point to counteract the danger to navigation from cross-tidal currents. After passing the bar 8½ feet can be carried to Nomini Ferry, 3 miles above the mouth.

The amount expended during the fiscal year ending June 30, 1883, was $121.46 for surveys. These surveys showed that shoaling had taken place in the channel forming bars, which, when low water is reduced by northerly winds, become serious obstructions to navigation.

The engineer in charge recommends widening the channel to a uniform width of 150 feet to secure its permanency, and the dredging of a training-channel and sinking a mattress, to divert a cross-current detrimental to the integrity of the main channel. The engineer bases upon later examinations an estimate of $18,500 required to complete the improvement, and recommends an appropriation of $10,000 for the fiscal year ending June 30, 1885.

Amount appropriated by act passed August 2, 1882	$2,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	121 46
July 1, 1883, amount available	1,878 54
Amount (estimated) required for completion of existing project	18,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	10,000 00

(See Appendix J 4.)

5. *Harbor at entrance of Saint Jerome's Creek, Maryland.*—The project for the improvement of this harbor was adopted in 1881, and contemplates dredging a channel 100 feet wide and 9 feet deep at low water, through the outer bar at the mouth of the creek, and a channel 40 feet wide and 6 feet deep through the south prong of the creek, the material therefrom to be thrown up into a dike, if practicable, so as to form a pond of a portion of this south prong for the purposes of the United States Fish Commission.

The amount expended to June 30, 1882, was $6,500, with which progress in both the channels has been made.

Five thousand dollars was appropriated by act passed August 2, 1882. Work was recommenced on the inner channel, which has been opened to the Fish Commission Wharf in the upper pond, a distance of 3,050 feet. The amount required for the completion of the project is $15,000, and it is recommended that this sum be appropriated for the fiscal year ending June 30, 1885, if the work is to be continued.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4,872 26
July 1, 1883, amount available	127 74
Amount (estimated) required for completion of existing project	15.000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	15,000 00

(See Appendix J 5.)

6. *Rappahannock River, Virginia.*—The present project for the improvement of this river was adopted in 1871 and modified in 1879, the object being to provide a channel 150 feet wide and 10 feet deep through the bar at Fredericksburg, channels 100 feet wide and 10 feet deep through the bars between Fredericksburg and Port Royal, and channels 200 feet wide and 15 feet deep through two bars between Port Royal and Tappahannock, where a larger class of vessels will need to be provided for.

The amount expended to June 30, 1882, was $125,429.60, and during the fiscal year ending June 30, 1883, $19,044.76 has been expended, making a total to June 30, 1883, of $144,474.36.

This expenditure has resulted in securing, by means of dredging at various times and the construction of longitudinal and spur dikes, navigable channels at Fredericksburg, Pollock's, Pratt's, Spottswood, and Castle's Ferry bars, and the removal of wrecks, drift-logs, and snags at other points. During the fiscal year ending June 30, 1883, dikes have been constructed at Fredericksburg, Barnard's, Castle's Ferry, and Farleyvale bars, and dredging at Fredericksburg, Pollock's, and Castle's Ferry bars.

The engineer in charge presents a detailed history of the operations of the improvement, and estimates for its completion in accordance with the above project. The amount asked for the fiscal year ending June

30, 1885, is $50,000, to be applied to the completion of the improvements between Fredericksburg and Port Royal, and if found practicable the commencement of operations on the two bars below Port Royal.

July 1, 1882, amount available		$5,425 74
Amount appropriated by act passed August 2, 1882		17,000 00
		22,425 74
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$19,044 76	
July 1, 1883, outstanding liabilities	876 31	
		19,921 07
July 1, 1883, amount available		2,504 67
Amount (estimated) required for completion of existing project		233,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		50,000 00

(See Appendix J 6.)

7. *Totusky River, Virginia.*—The obstructions to the navigation of this river consisted of a bar at its mouth, which forms a part of the wide flat between the outlet of the river and the navigable channel of the Rappahannock, having a least depth of 4½ feet, and a bar about 2½ miles above the mouth, known as Booker's Bar, having a ruling depth of 3 feet.

The improvement at Booker's Bar is needed for the purposes of navigation.

The first appropriation was made June 14, 1880, amounting to $2,500, but, being too small to accomplish economical results, its expenditure was deferred. An additional appropriation of $2,500 was made March 3, 1881, and proposals for building a dike at Booker's Bar were invited. But a single proposal was received, and this was too high to permit the accomplishment of the work under the amount then available. It was therefore decided to defer the expenditure of the appropriation until an additional amount should be granted by Congress.

On August 2, 1882, an additinoal appropriation of $5,000 was made, making the fund available about $9,945. This being sufficient, the proposed longitudinal dike was built. The effect of this dike will be to concentrate the current and to scour out the channel, but this action will be dilatory. The channel should be dredged if prompt improvement of the navigation is desirable.

For this object $10,000 will be required.

July 1, 1882, amount available		$4,945 81
Amount appropriated by act passed August 2, 1882		5,000 00
		9,945 81
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		8,242 65
July 1, 1883, amount available		1,703 16
Amount (estimated) required for completion of existing project		24,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		10,000 00

(See Appendix J 7.)

8. *Urbana Creek, Virginia.*—Prior to the commencement of this improvement the navigation was obstructed by a bar at the mouth, over which but 6½ feet of water could be carried.

The present project for the improvement was adopted in 1879, the

object being to excavate a channel through this bar 150 feet wide and 10 feet deep.

The amount expended to June 30, 1882, was $11,478.69, and during fiscal year ending June 30, 1883, $411.51, making a total to June 30, 1883, of $11,890.20.

This expenditure has resulted in securing a channel through the outer bars of 10 feet depth at low water, and a width of 140 feet, with the ends of the channel widened for facility in entering.

A turning-basin, 180 feet wide, 300 feet long, and 10 feet deep, has also been made at Urbana Wharf.

The engineer in charge asks, for the completion of this work, an appropriation of $5,000 for the year ending June 30, 1885.

July 1, 1882, amount available	$21 27
Amount appropriated by act passed August 2, 1882	4,000 00
	4,021 27
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	411 51
July 1, 1883, amount available	3,609 76
Amount (estimated) required for completion of existing project	5,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	5,000 00

(See Appendix J 8.)

9. *Mattaponi River, Virginia.*—Previous to the commencement of this improvement, the Mattaponi River was obstructed by numerous bars, and by snags, wrecks, and overhanging trees.

The present project for the improvement was adopted in 1880, the object being to provide a channel 40 feet wide, and 5½ feet deep at low water, by the removal of the snags, drift logs, wrecks, and overhanging trees, and by dredging through the bars.

The amount expended to June 30, 1882, was $5,030.15; and during the fiscal year ending June 30, 1883, $769.85; making a total to June 30, 1883, of $5,800, which has resulted in securing an efficient plant for snagging operations, and the removal of snags, logs, and overhanging trees for a length of river of about 24 miles.

An appropriation of $10,000 is recommended to be applied to the continuation of the improvement.

July 1, 1882, amount available	$769 85
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	769 85
Amount (estimated) required for completion of existing project	28,300 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	10,000 00

(See Appendix J 9.)

10. *Pamunkey River, Virginia.*—The present project for the improvement of this river was adopted in 1880, the object being to provide a channel 40 feet wide and from 5 to 6 feet deep at low water, by the removal of snags, logs, wrecks, and overhanging trees, and dredging through the bars.

The amount expended to June 30, 1882, was $4,834.28, and during the fiscal year ending June 30, 1883, $166.72; making a total to June 30, 1883, of $5,001. This expenditure has resulted in securing a plant for snagging operations, and the improvement of 20 miles of the river; 8 wrecks, and 1,721 snags, logs, and trees having been removed.

The appropriation of $10,000 asked for is to be applied to completing the improvement.

July 1, 1882, amount available	$166 72
Amount appropriated by act passed August 2, 1882	2,500 00
	2,666 72
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	166 72
July 1, 1883, amount available	2,500 00
Amount (estimated) required for completion of existing project	10,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	10,000 00

(See Appendix J 10.)

11. *York River, Virginia.*—The navigation of York River, Virginia, prior to the commencement of the present improvement, was obstructed by a bar at the mouth of Potopotank Creek, having a least depth of 21 feet, and a bar immediately below, and at West Point, Va., having a least depth of 14 feet.

The present project for the improvement of this river was adopted in 1880, the object being to provide a channel, by dredging, 22 feet deep and 200 feet wide (to be increased afterwards to 400 feet wide), through the bars, and also a basin of the same depth at the wharves at West Point.

The first appropriation for this improvement was made June 14, 1880, of $10,000, which was applied to the improvement of the Potopotank Creek Bar.

A channel 105 feet wide and 22 feet deep has been secured by dredging through Potopotank Bar.

The amount expended to June 30, 1882, was $34,900.41, and during the fiscal year ending June 30, 1883, $20,306.46, making a total to June 30, 1883, of $55,206.87. This has secured through the West Point Bar, in addition to the improvement of the Potopotank Bar, a channel 120 feet wide from the upper end of the bar a distance of 7,800 feet; 146 feet wide for 1,700 feet at turn; and 100 feet wide for 1,600 feet to lower end of bar, a total distance of 11,100 feet with 22 feet depth.

An appropriation of $50,000 is asked for to complete the improvement at West Point during the fiscal year ending June 30, 1885.

July 1, 1882, amount available	$99 59
Amount appropriated by act passed August 2, 1882	25,000 00
	25,099 59
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	20,306 46
July 1, 1883, amount available	4,793 13
Amount (estimated) required for completion of existing project	50,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	50,000 00

(See Appendix J 11.)

12. *Chickahominy River, Virginia.*—The present project for the improvement of this river was adopted in 1878, the object being to dredge channels 100 to 150 feet wide through Binn's, Old Fort and Windsor Shades bars to a depth of not less than 8 feet at low water, and to remove snags, logs, &c., from points above Windsor Shades. The least depths on these bars, prior to the commencement of the improvement, were 4 and 5 feet at low water.

The amount expended to June 30, 1883, was $8,241.63, and during the fiscal year ending June 30, 1883, $6,207.20, making a total to June 30, 1883, of $14,448.83, which expenditure has resulted in securing a channel through Binn's Bar 150 feet wide and 8 feet deep, and through Windsor

Shades and Old Fort bars 100 feet wide and 8 feet deep, and through the bar at the mouth of the river 90 feet wide and 14 feet deep at low water.

For the completion of the existing project an appropriation of $13,000 is recommended.

July 1, 1882, amount available		$1,758 37
Amount appropriated by act passed August 2, 1882		5,000 00
		6,758 37
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		6,207 20
July 1, 1883, amount available		551 17
Amount (estimated) required for completion of existing project		13,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		13,000 00

(See Appendix J 12.)

13. *Staunton River, Virginia, between Roanoke Station and Brookneal.*—The present project for the improvement of this river, between Roanoke Station, on the Richmond and Danville Railroad, and Brookneal, 31 miles above, was adopted in 1879, the object being to secure a navigable channel not less than 35 feet wide and 2 feet deep at low water, through the various ledges and sand bars which obstruct the navigation, with a slope of water surface at rapids not greater than 10 feet to the mile.

The amount expended to June 30, 1882, was $17,262.03, and during the fiscal year ending June 30, 1883, $1,489.20 has been expended, making a total to June 30, 1883, of $18,751.23, which has resulted in securing a survey of the river from Roanoke Station, at the crossing of the Richmond and Danville Railroad, to Brookneal, the construction of derrick-boats and quarter-boats, the improvement of Hawk Mountain Shoal, Horseback Shoal, and a portion of Clark's Shoal.

The channel has been improved for a distance of 4 miles by the excavation of rock, and for 3 miles by the construction of spur dikes.

An appropriation of $15,000 is asked, to continue the improvement during the year ending June 30, 1885, between Roanoke Station and Brookneal.

July 1, 1882, amount available		$237 97
Amount appropriated by act passed August 2, 1882		5,000 00
		5,237 97
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		1,489 20
July 1, 1883, amount available		3,748 77
Amount (estimated) required for completion of existing project		46,200 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		15,000 00

Staunton River, Virginia, between Brookneal and Pig River.—The present general project for the improvement of this river between Brookneal and Pig River was adopted in 1882, the object being to secure a navigable channel for bateau navigation not less than 14 feet wide, and 1½ to 2 feet deep at low water, with a slope of water surface at rapids not greater than 10 feet to the mile.

After a survey in 1882 of the river from the bridge of the Virginia Midland Railroad to Pig River, a distance of 23½ miles, Clement's Falls was selected as most in need of improvement. The project for improving Clement's Falls was adopted in 1883, the object being to

secure a channel 14 feet wide, and 1½ feet deep at low water, with water-surface slope of about 5 feet to the mile.

The amount expended to June 30, 1883, has been $508.94, for survey from bridge of Virginia Midland Railroad to Pig River.

Amount appropriated by act passed August 2, 1882	$2,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	508 94
July 1, 1883, amount available	1,491 06
Amount (estimated) required for completion of existing project	38,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	10,000 00

(See Appendix J 13.)

14. *Dan River, between Madison, North Carolina, and Danville, Virginia.*—The project for this improvement was adopted in 1880, the object being to afford a channel for navigation not less than 35 feet wide and not less than 1½ feet deep in the pools, and 2 feet deep in the rapids at extreme low water.

The project was afterward modified to a channel of not less than 16 feet wide, and 2½ feet deep in the rapids at extreme low water, which have been the dimensions excavated. It is believed that these depths of excavation will give for six months of the year a channel with a depth of not less than 3½ feet.

The amount expended to June 30, 1882, was $17,212.95, and during the fiscal year ending June 30, 1883, $4,030.28, making a total to June 30, 1883, of $21,243.23.

These expenditures have resulted in securing an efficient outfit of derrick-boats, scows, &c., and the improvement of about 4⅛ miles of the river, between Danville and Old House Ledge.

An appropriation of $15,000 is recommended for continuing the improvement during the year ending June 30, 1885.

July 1, 1882, amount available	$786 05
Amount appropriated by act passed August 2, 1882	7,500 00
	8,286 05
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4,030 28
July 1, 1883, amount available	4,255 77
Amount (estimated) required for completion of existing project	26,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	15,000 00

(See Appendix J 14.)

15. *Roanoke River, North Carolina.*—The project for the improvement of this river was adopted in 1871, the object being to improve navigation by the removal of rocks near Weldon and Halifax, and all wrecks, snags, and overhanging trees, at various other points, and dredging channels through the numerous bars and shoals.

The amount expended to June 30, 1878, was $45,000, and since this date no funds have been available for the continuation of the work.

On account of a land-slide which occurred at McRae's Landing, $5,000 was appropriated by act of August 2, 1882.

During the year 1883 a new dike at McRae's Landing was built and a portion of the old one repaired.

New surveys have been made to ascertain changes which have taken place since the survey of 1871, and a report will be shortly submitted containing recommendations. For this purpose and for completing the

improvement, an appropriation of $10,000 is recommended for the year ending June 30, 1885.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	1,274 81
July 1, 1883, amount available	3,725 19
Amount (estimated) required for completion of existing project	10,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	10,000 00

(See Appendix J 15.)

16. *French Broad River, North Carolina.*—The first project for the improvement of this river was adopted in 1878, the object being to secure a channel 35 feet wide and not less than 2½ feet deep at low water, between Brevard and Big Buck Shoal, a distance of 31½ miles.

The amount expended to June 30, 1882, was $37,780.22, with which expenditure the following results have been attained:

A survey of the river between Brevard and Big Buck Shoal, the improvement of the various shoals and rapids, by means of rock and gravel excavation, and the construction of wing-dams for a distance of 26 miles below Brevard.

For the completion of the improvement from Brevard to Big Buck Shoal $12,000 will be required.

The act of August 2, 1882, appropriated $5,000 for improving the river "from Smith's Bridge up."

A survey from Smith's Bridge (near Asheville) to the foot of Long Shoals, a distance of 12⅛ miles, was made in 1882, and a project adopted for securing a channel 30 feet wide and not less than 2¼ feet deep at low water for this distance.

For the completion of the improvement between Smith's Bridge and Big Buck Shoal, $12,000 will be required, making the aggregate amount required for the completion of the improvement of the river from Smith's Bridge to Brevard $24,000.

July 1, 1882, amount available	$9 08
Amount appropriated by act passed August 2, 1882	5,000 00
	5,009 08
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	1,364 60
July 1, 1883, amount available	3,644 48
Amount (estimated) required for completion of existing project	24,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	24,000 00

(See Appendix J 16.)

IMPROVEMENT OF THE HARBORS OF NORFOLK, VIRGINIA, AND BEAUFORT, NORTH CAROLINA; OF CURRITUCK SOUND, COANJOK BAY, AND NORTH RIVER AND BAR; IMPROVEMENT OF CERTAIN RIVERS IN VIRGINIA NORTH CAROLINA, AND SOUTH CAROLINA.

Officer in charge, Capt. James Mercur, Corps of Engineers.

1. *Harbor at Norfolk, Virginia, and its approaches.*—The act of March 3, 1881, appropriated $75,000 for this work, under which a contract for the removal of 600,000 cubic yards, more or less, of material remained incomplete at the beginning of the fiscal year July 1, 1882. A provisional extension was granted the contractor, to allow him to finish the work, but he not fulfilling the conditions under which the extension

was granted, the contract expired under its terms with a forfeiture of retained percentage.

The river and harbor act of August 2, 1882, appropriated $75,000 for continuing this improvement. A contract was entered into for the removal of 500,000 cubic yards, more or less, of material from the harbor. This contract expires November 30, 1883.

Up to the close of the fiscal year there had been removed under the contract—

	Cubic yards.
From Eastern Branch Elizabeth River	91,843
From Southern Branch Elizabeth River	18,942
From vicinity of Town Point	134,231
From Sewall's Point Bar	178,994
Total	424,010

The completion of this contract will give a channel 200 feet wide and 25 feet deep at low water through Sewall's Point Bar; widen the channel below Town Point to nearly the width contemplated between the Port Wardens' lines; secure a channel of 25 feet depth, but somewhat contracted in width up to the Navy-Yard, and enlarge the harbor by rendering available to deep-draught vessels all that part of the Eastern Branch below the Norfolk and Western Railroad Bridge, and above the site of the old draw-bridge which was removed last year.

The growing commerce of the harbor has created a need for more wharf facilities and greater area for anchorage. Urgent recommendations are made by the commercial interests that the Berkely Flats should be removed, and a new naval anchorage made below Fort Norfolk, the first to allow vessels to approach the Berkely shore, where wharves will be built; and the second to leave open for general navigation the part of the channel near Fort Norfolk sometimes occupied now by naval vessels lying at anchor. It is for the commencement of this additional work that an increased appropriation is asked for.

July 1, 1882, amount available		$49,015 98
Amount appropriated by act passed August 2, 1882		75,000 00
Amount received from Capt. Jas. Mercur for fuel		67 50
		124,083 48
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$81,902 52	
July 1, 1883, outstanding liabilities	8,998 28	
		90,900 80
July 1, 1883, amount available		33,182 68
Amount (estimated) required for completion of existing project		18,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		75,000 00

(See Appendix K 1.)

2. *Archer's Hope River, Virginia.*—The river and harbor act of August 2, 1882, appropriated $5,000 for continuing the improvement of this river.

Under this appropriation a contract was entered into for dredging 18,000 cubic yards, more or less, of material, with a view to securing a channel of 50 feet width and 6 feet depth at low water, from the mouth of the river so far up toward Williamsburg as the funds available would allow. Under this contract 16,524 yards of material were removed, when the near exhaustion of the appropriation necessitated stopping the work.

The work done in this and the last fiscal year has opened a channel into the creek, but an inner bulkhead of sand and the obstructions farther up the stream must be removed before any material benefit to navigation will be secured.

July 1, 1882, amount available		107 97
Amount appropriated by act passed August 2, 1882		5,000 00
		5,107 97
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$4,838 76	
July 1, 1883, outsanding liabilities	75 00	
		4,913 76
July 1, 1883, amount available		194 21
Amount (estimated) required for completion of existing project		9,400 70
Amount that can be profitably expended in fiscal year ending June 30, 1885		9,400 00

(See Appendix K 2.)

3. *Pagan Creek, Virginia.*—The river and harbor act passed August 2, 1882, made no appropriation for this work.

There have been no operations during the fiscal year.

July 1, 1882, amount available	$177 53
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	177 53
Amount (estimated) required for completion of existing project	18,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	18,000 00

(See Appendix K 3.)

4. *Blackwater River, Virginia.*—Under the appropriation of $1,500 made by the river and harbor act of March 3, 1881, dredging operations commenced early in July, for cutting off the troublesome points in the short bends of the river, and continued until July 22, when the near exhaustion of the appropriation caused a stoppage of work.

The river and harbor act of August 2, 1882, appropriated $1,500 for continuing the improvement. The expense of towing dredging machinery to this river is so great that no work has been done under this appropriation up to this date, but it is expected that a dredge will soon be engaged near this river, when advantage will be taken of this fact, and its services will be secured for continuing the work so far as the funds will allow.

July 1, 1882, amount available		$1,490 36
Amount appropriated by act passed August 2, 1882		1,500 00
		2,990 36
July 1, 1882, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		1,385 93
July 1, 1883, amount available		1,604 43
Amount (estimated) required for completion of existing project		850 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		1,000 00

(See Appendix K 4.)

5. *Nottoway River, Virginia.*—No appropriation was made for this work under the last river and harbor act.

The carelessness of those rafting timber on the river, in allowing logs to sink in the channel, has caused the condition of the upper part of the river to be nearly as bad as it was before any work of improvement was undertaken.

No increase of commerce seems to have followed the improvement of

the river, the navigation being restricted to flat-boats, bateaux, and rafts.

July 1, 1882, amount available	$579 70
July 1, 1883, amount available	579 70
Amount (estimated) required for completion of existing project	2,000 00

(See Appendix K 5.)

6. *North Landing River, Virginia and North Carolina.*—The river and harbor act of August 2, 1882, appropriated $8,000 for this river, and a balance of $1,250.92 remained available from former appropriations.

No work has been done on this river during the fiscal year, as the capacity of the river was sufficient to accommodate all vessels which could pass through the Albemarle and Chesapeake Canal, and no others navigate this river.

The project for the improvement of the river contemplates securing a channel of 80 feet width and 9 feet depth at ordinary low water. During the year some sunken logs, &c., have caused obstructions in the river, and it is proposed to commence operations for their removal and cutting away shoals, if found, when the cold weather will allow the work to be done with less suffering from malarial diseases on the part of the employés.

July 1, 1882, amount available	$1,250 92
Amount appropriated by act passed August 2, 1882	8,000 00
	9,250 92
July 1, 1883, amount available	9,250 92
Amount (estimated) required for completion of existing project	32,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	25,000 00

(See Appendix K 6.)

7. *Meherrin River, North Carolina.*—The river and harbor act of August 2, 1883, appropriated $5,000 for the improvement of this river. The difficulty in securing suitable machinery delayed the beginning of work until late in June, when, a proper plant being obtained, operations commenced for clearing the river of logs, trees, &c., from its mouth up to Murfreesborough, or so far as the money appropriated will allow, and were continued until the end of the fiscal year.

The project for improvement includes dredging at two or three points, should it be found necessary after the removal of the other obstructions.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, outstanding liabilities	163 19
July 1, 1883, amount available	4,836 81
Amount (estimated) required for completion of existing project below Murfreesborough	7,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	7,500 00

(See Appendix K 7.)

8. *Currituck Sound, Coanjok Bay, and North River and Bar, North Carolina.*—The river and harbor act of August 2, 1882, appropriated $20,000 for this work.

The project for this work contemplates securing a channel of 80 feet wide by 9 feet deep from the mouth of North Landing River to Albemarle Sound. Under this project a contract was made for dredging 80,000 cubic yards, more or less, from Coanjok Bay, and work was commenced January 3, 1883. Delays arising from breakage of machinery, and the necessity for frequent removals of the machines to allow ves-

sels to pass, prevented the completion of the work at the specified time, and the contract was extended three months, or to September 30, 1883.

Up to the end of the fiscal year, 37,441 cubic yards were removed and deposited on the west side of the cut behind the shell bank.

The shell bank previously built was strengthened by the addition of 26,826 bushels of oyster shells, bought in open market, and the bank at the northeast end of the cut was protected by 160 linear feet of sheet piling.

This work is all in the route of inland navigation, via the Albemarle and Chesapeake Canal, at whose expense the cut through Coanjok Bay was originally constructed.

July 1, 1882, amount available		$1,127 41
Amount appropriated by act passed August 2, 1882		20,000 00
		21,127 41
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$12,686 33	
July 1, 1883, outstanding liabilities	1,394 57	
		14,080 90
July 1, 1883, amount available		7,046 51
Amount (estimated) required for completion of existing project		20,213 95
Amount that can be profitably expended in fiscal year ending June 30, 1885		20,200 00

(See Appendix K 8.)

9. *Scuppernong River, North Carolina.*—There was no appropriation for this work in the act of Congress of August 2, 1882.

There have been no operations during the fiscal year.

July 1, 1882, amount available	$10 64
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	10 64
Amount (estimated) required for completion of existing project	2,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	2,000 00

(See Appendix K 9.)

10. *Pamplico and Tar Rivers, North Carolina.*—Ten thousand dollars were appropriated by the river and harbor act of August 2, 1882, for these rivers.

The condition of the Pamplico was and is such that no further improvement is needed at this time.

The operations for the improvement of the Tar were very much impeded by continued high water, which, however, enabled the steamers to run through to Tarborough for at least ten months of the year, which is far above the average period.

The banks of the Tar were trimmed of overhanging trees from Tarborough to Greenville. Some stumps and logs were taken from the river; two jetties were built and two repaired, and the working plant was put in good order for continuing work when the stage of the water is favorable. While unable to work on the river the working parties were discharged.

The river will be kept clear of logs, trees, &c., and such repairs as may be needed will be made to the existing jetties, and, if considered necessary, new ones will be built. The work of improvement contemplated in the original estimates upon this river is complete, but a continuance of its best possible condition requires a small annual expenditure upon it.

July 1, 1882, amount available		$2,069 28
Amount appropriated by act passed August 2, 1882		10,000 00
		12,069 28
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,906 75	
July 1, 1883, outstanding liabilities	26 00	
		3,932 75
July 1, 1883, amount available		8,136 53
Amount that can be profitably expended in fiscal year ending June 30, 1885		12,000 00

(See Appendix K 10.)

11. *Neuse River, North Carolina.*—The river and harbor act of August 2, 1882, appropriated $35,000 for this river, "$5,000 of which shall be applied to the improvement of the line of inland navigation from New Berne to Beaufort Harbor."

There being two routes of inland navigation between New Berne and Beaufort, and no data as to which was intended to be improved existing, no expenditure has been made from this $5,000 pending the selection of the proper route.

Work has continued on the Neuse, in accordance with the approved project, for obtaining a clear navigation to Smithfield, 175 miles above New Berne. The river has been cleared of obstructions to Smithfield, giving a practicable navigation to this point, for six months in the year, to vessels drawing not more than 3 feet, and to lighter draught vessels for a longer term.

The completon of the jetties is expected to secure a 4-foot navigation to Kinston at all times of the year.

It is proposed to complete the system of jetties under construction and to remove such trees, &c., as may fall into the river.

The improvement of the river has been more extended than was originally contemplated, and the original estimates are not sufficient to complete the improvement in accordance with the needs of the largely increased commerce which has resulted from the work already done. The amount asked for will probably complete the improvement and preserve the channel for the remainder of the fiscal year.

A small annual appropriation will be required, however, to preserve the channel, owing to trees, &c., falling in the river from time to time.

July 1, 1882, amount available		$11,392 56
Amount appropriated by act passed August 2, 1882		35,000 00
		46,392 56
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$22,609 27	
July 1, 1883, outstanding liabilities	1,001 80	
		23,611 07
July 1, 1883, amount available		22,781 49
Amount (estimated) required for completion of existing project		30,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		30,000 00

(See Appendix K 11.)

12. *Trent River, North Carolina.*—The river and harbor act of August, 1882, appropriated $10,000 for this river.

A working party was engaged during November, December, and January trimming the banks and removing logs, &c., from the channel. This work was completed in January, and efforts were made to secure a dredge for continuing the improvement.

No suitable dredge was secured up to the end of the fiscal year, but

it is expected that one will soon be available, when dredging operations will be commenced and continued so long as the appropriation holds out.

The original estimate for the improvement of this river was $22,000. The progress of the work showed the existence of shell rock in the channel and many more snags, &c., than were found in the original survey.

The development of commerce following the improvement showed the necessity of completing the improvement and making the river navigable for longer and broader boats than was originally contemplated.

The act of August 2, 1882, appropriated $10,000 beyond the original estimates, and it is estimated that $35,000 more will be needed to complete the improvement in a satisfactory manner.

It is proposed to continue the improvement by straightening and deepening the channel and completing the turning basin at Trenton by the use of dredges.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$1,557 38	
July 1, 1883, outstanding liabilities	40 00	
		1,597 38
July 1, 1883, amount available		8,402 62
Amount (estimated) required for completion of existing project		35,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		25,000 00

(See Appendix K 12.)

13. *Contentnia Creek, North Carolina.*—The river and harbor act of August 2; 1882, appropriated $10,000 for this work.

Work has been carried on in accordance with the approved project, and the creek has been cleared of logs and trees so far as Snow Hill, 45 miles above its mouth. A large amount of work has also been done in the Lower Narrows.

This work has been of large benefit to commerce, steamers now running regularly during the fall, winter, and spring months where they were never seen before. With a continuance of appropriations the navigation can be extended further up the stream.

July 1, 1882, amount available		$306 01
Amount appropriated by act passed August 2, 1882		10,000 00
		10,306 01
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$8,421 64	
July 1, 1883, outstanding liabilities	1,014 25	
		9,435 89
July 1, 1883, amount available		870 12
Amount (estimated) required for completion of existing project		20,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		20,000 00

(See Appendix K 13.)

14. *Beaufort Harbor, North Carolina.*—Thirty thousand dollars were appropriated by the river and harbor act of August 2, 1882, for this work, "$5,000 of which shall be applied to the improvement of the line of inland navigation from Beaufort Harbor to New Berne." None of this $5,000 has yet been expended, as the route intended by the act to be improved is not known. The work at Beaufort Harbor has consisted in extending the jetty started last year to a length of 535 feet, and building a short jetty 100 feet long on the inner side of the point.

Owing to lack of facilities for work at this point, it was necessary to construct a quite expensive plant of scows, wharves, tramways, &c. The action of the jetties has been very satisfactory, building out the shore for several hundred feet and causing an extensive filling of sand. The completion of the work promises well, by securing the object sought, of protecting the point and restoring, in a great degree, the portion washed away, thus securing the safety of the main entrance.

July 1, 1882, amount available		$25,897 09
Amount appropriated by act passed August 2, 1882		30,000 00
		55,897 09
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$31,313 95	
July 1, 1883, outstanding liabilities	2,513 75	
		33,827 70
July 1, 1883, amount available		22,068 39
Amount (estimated) required for completion of existing project		22,103 38
Amount that can be profitably expended in fiscal year ending June 30, 1885		22,100 00

(See Appendix K 14.)

15. *Cape Fear River from Wilmington to Fayetteville, North Carolina.*—The river and harbor act of August, 1882, appropriated $30,000 for this river.

Operations have been conducted under this appropriation in removing trees, logs, stumps, and snags from the channel and in trimming the banks of overhanging trees. The continued high water during the year has prevented any jetties being built for contracting the river, but the necessary plant has been prepared, and work upon them will begin so soon as the stage of the water is suitable for it.

A light-draught steamer has been under construction, and is nearly completed, for use in towing and carrying supplies when the river is too low to allow the regular boats to run.

Navigation has been much improved during the year, but an annual expenditure will be needed to keep the river free from trees, snags, &c., which are carried into it at each of the high freshets which frequently occur. This work has been done by hired labor and the purchase of material in open market.

The original estimates submitted were for a partial improvement of the river only. The progress of the work has necessitated the construction of a proper working plant, all of which will soon be available for construction of jetties and keeping the river clear of obstructions. Jetties will be built as needed, and the hoisting machinery will be engaged on such parts of the river as become obstructed by snags, &c. The cutting away of overhanging trees will be continued where needed.

The amount of annual appropriation required cannot be stated until the effect of the jetties and the average number of trees carried into the river are known.

July 1, 1882, amount available		$15,186 04
Amount appropriated by act passed August 2, 1882		30,000 00
		45,186 04
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$10,344 60	
July 1, 1883, outstanding liabilities	2,642 85	
		12,987 45
July 1, 1883, amount available		32,198 59
Amount that can be profitably expended in fiscal year ending June 30, 1885		25,000 00

(See Appendix K 15.)

16. *Lillington River, North Carolina.*—The river and harbor act of March 3, 1881, appropriated $3,000 for this work, but, owing to the impracticability of obtaining the necessary machinery, no work was undertaken until the additional appropriation of $3,000, made by the river and harbor act of August 2, 1882, became available.

Under these appropriations work was commenced in December, 1882, in accordance with a project contemplating clearing the river of all obstructions and cutting off the very sharp bends between the mouth of the river and the town of Lillington, 11 miles above; these obstructions existing only in the upper part of the river.

Up to the close of the fiscal year the river had been cleared of logs, snags, stumps, &c.; the banks had been trimmed of overhanging trees, and the longest of the proposed cuts was nearly completed.

The work was done by hired labor and purchase of material in open market. It is believed that the appropriation made will complete the improvement in accordance with the existing project.

July 1, 1882, amount available		$3,000 00
Amount appropriated by act passed August 2, 1882		3,000 00
		6,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$2,254 75	
July 1, 1882, outstanding liabilities	644 15	
		2,898 90
July 1, 1883, amount available		3,101 10

(See Appendix K 16.)

17. *Town Creek, North Carolina.*—The river and harbor act of March 3, 1881, appropriated $1,000 for the improvement of this stream. Owing to the impracticability of hiring suitable machinery no work was done under this appropriation until during the last fiscal year, when, taking advantage of a time when high water in the Cape Fear prevented the use of the machinery belonging to that stream, it was transferred to this creek, and the logs, snags, wrecks, &c., obstructing the channel were removed, and the banks cleared of the most troublesome overhanging trees.

The services of a dredge, extemporized from a steam hoister, were then secured, and a narrow channel of 3½ feet depth was dredged through the obstructing shoals. This completed a modified project based upon the small amount of money available, and secures a channel which gives satisfactory flat-boat navigation over the stream. A further expenditure of about $2,000 would open the stream to light-draught steamers.

It is found that all desirable improvement can be carried out for a much less sum than was originally estimated, viz, $9,078.48.

July 1, 1882, amount available	$1,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	1,000 00
Amount (estimated) required for completion of existing project	8,078 48
Amount that can be profitably expended in fiscal year ending June 30, 1885.	2,000 00

(See Appendix K 17.)

18. *Yadkin River, North Carolina.*—Under the appropriation of $25,000 made by the river and harbor act of August 2, 1882, operations have been continued on this river in accordance with the approved project for securing a channel for light-draught steamers from the North Carolina Railroad Bridge up to Bean Shoal. The river being obstructed by mill-dams, no authority for the removal of which or for purchasing right of way through them exists, all work has been restricted to that portion of the river, 21½ miles in length, between Swicegood's Mill, the lowest on the river, and the North Carolina Railroad Bridge.

These operations have consisted in removing sand and rock from the

shoals and ledges, and building wing-dams and training-walls between these points.

The hoister and quarter-scows have been repaired and cared for during suspension of work at times of high water and cool weather.

Upon the completion of the channel to the lower mill-dam operations will stop until free right of way is granted to the United States, or specific enactments are made authorizing the removal of the dams.

July 1, 1882, amount available		$17,935 20
Amount appropriated by act passed August 2, 1882		25,000 00
		42,935 20
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$9,061 88	
July 1, 1883, outstanding liabilities	1,001 43	
		10,063 31
July 1, 1883, amount available		32,871 89

(See Appendix K 18.)

19. *New River, North Carolina.*—The river and harbor act of August 2, 1882, appropriated $5,000 for this river.

This amount is not sufficient to justify beginning a work at this point, since the danger attendant upon taking machinery to the work, which can only be done by going to sea and entering through a shoal and dangerous inlet, would cause dredge-owners to charge a prohibitory price for the work, the estimated cost of which, if all done under one contract, is $40,000.

It is not considered advisable to begin this work until a larger amount of money is available.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount available	5,000 00
Amount (estimated) required for completion of existing project	35,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	35,000 00

(See Appendix K 19.)

20. *Great Pee Dee River, South Carolina.*—The river and harbor act of August 2, 1882, appropriated $6,000 for this river, which has been expended, under the approved project, in trimming the banks of the river in its upper part, and in removing sunken logs and trees below Smith's Mills, 47 miles above the mouth of the river.

The work, so far as carried, affords satisfaction to the navigation interests on the river, and is of great benefit to the people near its banks. The improvements made up to this time allow steamers to run 50 miles further up the river, at low water, than they could before work began.

During the progress of the work, it has been found out that the number of obstructions existing was much greater than was estimated in the examination, necessarily hurried, upon which this estimate was based. A revised estimate places the expense of completing the work at $25,300, with a statement that it is possible this amount may be exceeded, owing to the fact that many trees, &c., are sunken in the sand and appear only after others have been removed.

July 1, 1882, amount available		$119 90
Amount appropriated by act passed August 2, 1882		6,000 00
		6,119 90
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		5,947 37
July 1, 1883, amount available		172 53
Amount that can be profitably expended in fiscal year ending June 30, 1885		25,000 00

(See Appendix K 20.)

21. *Waccamaw River, South Carolina.*—The river and harbor act of August 2, 1882, appropriated $4,400 for this work.

Operations were carried on under the approved project, consisting in trimming the banks of overhanging trees, a party beginning work in April, and being still at work.

The progress of the work has shown that the original estimates are not sufficient to complete the improvement of the river, and a modified estimate of $25,300 is substituted for this object.

The work, so far as carried, is of decided benefit to the deep-draught vessels, allowing them to take full cargoes from the mills instead of being obliged to lighter a large part of their cargo below the shoals.

July 1, 1882, amount available		$612 03
Amount appropriated by act passed August 2, 1882		4,400 00
		5,012 03
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$2,386 31	
July 1, 1883, outstanding liabilities	348 85	
		2,735 16
July 1, 1883, amount available		2,276 87
Amount that can be profitably expended in fiscal year ending June 30, 1885		25,000 00

(See Appendix K 21.)

22. *Santee River, South Carolina.*—The river and harbor act of August 2, 1882, appropriated $20,000 for this work.

It was proposed to carry on this work in accordance with the project published in the last annual report by deepening and straightening Mosquito Creek by making three cuts for this purpose. Titles and right of way having been obtained, the work was advertised, but no bids for dredging were received, while the bids for building the drawbridge were so high they were rejected.

The title to the land through which two of the cuts pass being in dispute, no work will be undertaken upon this part of the work until this question is settled, but authority has been granted to make the other cut by hired labor and purchase of material in open market, since the completion of this cut will afford a navigable channel between Santee River and Winyah Bay. It is expected that active operations will begin early in July.

July 1, 1882, amount available		$20,627 06
Amount appropriated by act passed August 2, 1882		20,000 00
		40,627 06
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$93 29	
July 1, 1883, outstanding liabilities	227 58	
		420 87
July 1, 1883, amount available		40,206 19
Amount (estimated) required for completion of existing project		62,427 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		40,000 00

(See Appendix K 22.)

23. *Wateree River, South Carolina.*—Fifteen thousand dollars were appropriated by the river and harbor act of August 2, 1882, for this river. Under the appropriation work has been continued with a view to obtaining a depth of 4 feet in the channel.

After the appropriation became available the water continued too high to justify commencing work until May, 1883, from which date operations were continued up to the end of the fiscal year.

The channel is now unobstructed for vessels drawing 4 feet, from the bridge of the South Carolina Railroad to the mouth of the river, and the machinery and men are at work between this bridge and that of the Wilmington, Columbia, and Augusta Railroad, about 5 miles farther up the river. Both of these are closed bridges, allowing only 15 feet of head room at low water.

There is at present no commerce on the river. The amount which will be developed by the improvement is problematical.

July 1, 1882, amount available		$149 69
Amount appropriated by act passed August 2, 1882		15,000 00
		15,149 69
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities, July 1, 1882	$1,107 71	
July 1, 1883, outstanding liabilities	1,381 60	
		2,489 31
July 1, 1883, amount available		12,660 38
Amount (estimated) required for completion of existing project		31,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		31,000 00

(See Appendix K 23.)

24. *Georgetown Harbor, South Carolina.*—The river and harbor act of August 2, 1882, appropriated $7,000 for this work. This amount is not large enough to justify beginning a work, which, owing to its expensive character and absence of proper machinery and appliances, it could not complete, especially as the work, if not completed, would soon be destroyed. No operations have been commenced, and it is not considered advisable to begin any until more money is available.

Amount appropriated by act passed August 2, 1882	$7,000 00
July 1, 1883, amount available	7,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	25,000 00

(See Appendix K 24.)

IMPROVEMENT OF RIVERS AND HARBORS ON THE COAST OF SOUTH CAROLINA, GEORGIA, AND THE ATLANTIC COAST OF FLORIDA.

Officer in Charge Col. Q. A. Gillmore, Corps of Engineers, having under his immediate orders, First Lieut. W. T. Rossell, Corps of Engineers; Capt. James C. Post, Corps of Engineers, until April 20, 1883; Capt. Benjamin D. Greene, Corps of Engineers, until October 31, 1882; and First Lieut. Thomas N. Bailey, Corps of Engineers, since November 18, 1882. (During the interval between November 28, 1882, and March 31, 1883, the works were temporarily in charge of Captain Post.)

1. *Charleston Harbor, South Carolina.*—The works of improvement now in progress of construction comprise two jetties, composed of riprap stone, resting on a broad foundation mattress of logs and brush, with a mattress hearting whenever deemed expedient and advantageous.

The two jetties spring, respectively, from Sullivan's and Morris islands, and converge towards each other on curves in such a manner as to cross the bar on parallel lines at a distance of about 2,900 feet from each other. The object of the work is to establish and permanently maintain a practicable channel across the bar of not less than 21 feet navigable depth at mean low water, where heretofore the available low-water depth has not usually exceeded 11½ feet. Previous to the adoption of this project, in 1878, there had been expended in improving this harbor since the close of the civil war (1871 to 1878) the sum of $93,700 in taking up the wrecks of fourteen ironclad and wooden vessels and for other purposes.

North jetty.—Nothing was done on this work during the past fiscal year.

South jetty.—During the past fiscal year the foundation course of the south jetty was extended 2,657.7 feet seawards, of a uniform width of 108 feet, and a height varying from 2½ to 3 feet, composed of a log and brush mattress, about 18 inches thick, overlaid with riprap stone. The work was laid in low-water depth, varying from 10 to 16 feet. On either side of the extension, the foundation course of spurs was laid, about 200 feet from center to center, each course 50 feet wide along the edge of the jetty, and extending about 100 feet from it, north and south, respectively.

A second course of mattresses, 40 and 50 feet in width, was placed upon the bottom course of the south jetty, where the same crosses the main ship-channel, for a continuous length of 1,554 feet. At the same place the bottom course was widened on the south side by an additional apron of riprap stone resting on mattresses of 60 and 100 feet width, for a continuous length of 1,570 feet. The quantity of log and brush mattress, 18 inches thick, laid during the fiscal year, amounted to 80,299 square yards, and the amount of riprap stone to 35,753 cubic yards.

At the close of the fiscal year the seaward end of the south jetty had reached a point 12,779.7 feet from the shore of Morris Island, measured along the axis of the work and about 1 mile within the 18-foot curve on the outer slope of the bar. No work having been done on the north jetty, its seaward end remained as stated in my last annual report, or 14,361 feet from the shore of Sullivan's Island, measured along the axis of the work, and about 1,000 feet inside the 18-foot curve on the outer slope of the bar.

No settlement of the work, of any importance, was observed during the past fiscal year. A skilled diver has been employed to examine the condition of both jetties and of the sea bottom in their vicinity. The examination had not terminated at the close of the fiscal year.

The deep-water area between Fort Moultrie on Sullivan's Island and the north end of Morris Island has materially enlarged, and its 18-foot curve extends in a long pocket into Swash Channel between the jetties. The area of the deep-water basin just south of that pocket has also increased. The shoal between the main ship channel and Swash Channel has diminished in area, and has a greater depth of water upon it than formerly. Constant changes are going on in Swash Channel, owing to the irregular seaward movement of the sand between the jetties. Most of these changes and movements are ascribed to the influence of the works thus far constructed.

No special changes have been noticed during, the last fiscal year, in the sea shores of either Sullivan's or Morris islands, both of which in previous reports have been stated to be washing away. The shore of Sullivan's Island is protected by two spur jetties. One of these, located about 3,100 feet east of Fort Moultrie, was built in December, 1880. The other, located 1,800 feet east of Fort Moultrie, was built in September, 1881, as stated in the annual report of 1882.

With the funds on hand on July 1, 1883, it is proposed to raise the south jetty to a greater height at the lower places, and to extend its foundation course farther seaward. Some protective works will perhaps be constructed on the seaward shore of Morris Island. The work will be carried on by methods substantially the same as those heretofore followed. A general survey of the outer harbor and bar, lately commenced, will be completed.

The estimated cost of the north and south jetties, originally submitted March 9, 1878, was $1,800,000. This estimate did not include the short

spur jetties built and to be built for protecting the sea-shores in the vicinity of either jetty.

There has been appropriated to date the sum of $1,045,000. From the beginning of operations to June 30, 1883, there has been expended the sum of $945,531.99.

Amount appropriated by act passed August 2, 1882		$300,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$163,654 77	
July 1, 1883, outstanding liabilities	36,877 22	
		200,531 99
July 1, 1883, amount available		99,468 01
Amount (estimated) required for completion of existing project		755,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		755,000 00

(See Appendix L 1.)

2. *Wappoo Cut, South Carolina.*—The first appropriation made by Congress for improving Wappoo Cut, South Carolina, by act approved March 3, 1881, amounted to $10,000. Another appropriation of $10,000 was made by act passed August 2, 1882.

Wappoo Cut is a narrow, tortuous, tidal creek to the north of James Island, connecting Stono and Ashley rivers.

The project of improvement submitted by the engineer officer in charge contemplates the establishment of a straighter channel 6 feet by 90 feet low-water dimensions, at an estimated cost of $34,000. In its unimproved condition only 2 to 4 feet could be carried over the principal shoals at mean low tide.

The plan of improvement comprised dredging on the bar at the entrance from Ashley River, and at one place in the cut; a cut-off through the marsh about 2½ miles from Ashley River, closing three small tidal branches; and the construction of a short jetty at both the Stono and Ashley rivers.

With the sum of $20,000 made available for this work during the past fiscal year, a portion of Wappoo Cut was improved by dredging.

The channel in Elliott's Cut has now a low-water depth of 6 feet on a width of 60 feet. The cut-off through the marsh was completed to a low-water depth of 6 feet, and an average width of about 80 feet. The same depth was established, on a width of about 50 feet, through the shallow reach between the two places named. On the route thus improved the low-water depth was formerly but 2½ feet at the shoalest places. By means of the cut-off, the distance by water from Ashley River to Stono River, has been reduced from 5.5 miles to 3.6 miles.

Operations for widening and deepening the cut already made were still in progress at the end of the fiscal year, but will soon be closed, as the funds are nearly exhausted.

An early appropriation, sufficient to complete the project, is desirable.

July 1, 1882, amount available		$10,000 00
Amount appropriated by act passed August 2, 1882		10,000 00
		20,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$11,432 80	
July 1, 1883, outstanding liabilities	5,272 00	
		16,704 80
July 1, 1883, amount available		3,295 20
Amount (estimated) required for completion of existing project		14,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		14,000 00

(See Appendix L 2.)

3. *Edisto River, South Carolina.*—By the river and harbor act passed August 2, 1882, the sum of $8,000 was appropriated for improving Edisto River, South Carolina, this being the first appropriation made by Congress for this work. The Edisto is one of the principal rivers of South Carolina. It is formed by the junction of the North and South Forks, which unite in the southern part of Orangeburg County. The South Fork, commonly known as the South Edisto, is the main river.

The obstructions to navigation are caused by numerous bends, logs, snags, overhanging trees, and piles; also by shoals consisting generally of sand, but at some places of hard clay.

The plan of improvement submitted by the engineer officer in charge contemplates the establishment of a safe navigation channel at all seasons of the year from the sea to the junction of the North and South Forks, a distance of 183 miles; and from that point to Guinguards Landing, 77 miles higher up, for rafts and flat boats. The plan embraces enlarging and clearing all the new channels now in progress of formation, cutting off bends, shutting off lateral arms of the river, removing shoals, snags, logs, piles, and other obstructions, and building a deflecting jetty. The cost of the project is estimated at $33,385.

During the fiscal year just closed, the United States snag-boat Toccoa was employed for some months on the river. The river channel was cleared of a considerable number of piles, snags, and overhanging trees. A narrow cut-off, only 18 feet long, through the neck of a bend three-quarters of a mile around, was widened and deepened, and now forms the regular channel of the river at that place. The operations extended from the mouth of the river to Russell Lake, a distance of 110 miles.

During the present fiscal year operations will be continued with the balance on hand July 1, 1883, and in conformity to the project submitted by the engineer officer in charge December 31, 1880.

Amount appropriated by act passed August 2, 1882	$8,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	1,945 00
July 1, 1883, amount available	6,055 00
Amount (estimated) required for completion of existing project	25,385 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	25,400 00

(See Appendix L 3.)

4. *Salkiehatchie River, South Carolina.*—By the river and harbor act passed August 2, 1882, the sum of $5,000 was appropriated for improving this river; this being the first appropriation made by Congress for this object.

The Salkiehatchie, known as the Big Salkiehatchie, to distinguish it from its principal tributary, the Little Salkiehatchie, rises in Aiken County, South Carolina, and flows into the Atlantic Ocean. The two rivers unite about 80 miles from the sea-coast. The lower part of the river is known as the Combahee. Above a point named Hickory Bluff, about 44 miles from the sea-coast, the river channel is obstructed at many places by piles, logs, and sand shoals.

The project of improvement submitted by the engineer in charge contemplates the establishment of a continuous channel suitable for flat-boats and rafts, from a point 5 miles above Toby's Bluff down to Hickory Bluff, a length of 77 miles by river.

The work comprises the removal of logs, shoals, and piles, and cutting a navigable channel through two places known as Murdock's sand

drag, and Weekly sand drag, where the river at present is divided into numerous small streamlets, unfit for any kind of navigation.

The cost of the project is estimated at $18,000. During the month of June, last, the United States snag boat Toccoa removed a number of piles at Hickory Bluff, and some snags and overhanging trees for 9 miles higher up.

During the present fiscal year operations will be continued with the balance on hand July 1, 1883, and in conformity to the project submitted by the engineer officer in charge December 29, 1880.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, outstanding liabilities	587 50
July 1, 1883, amount available	4,412 50
Amount (estimated) required for completion of existing project	13,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	13,000 00

(See Appendix L 4.)

5. *Ashley River, South Carolina.*—Ashley River is about 40 miles in length, and runs in a generally southeasterly direction. At its mouth the city of Charleston occupies its left bank.

By act approved June 14, 1880, the sum of $1,000 was appropriated for this improvement, and the sum of $1,500 was appropriated by act approved March 3, 1881. These are the only appropriations ever made by Congress for improving this river.

A general description of the locality will be found in Appendix J 3, Annual Report of the Chief of Engineers for 1880.

The plan of improvement comprised—

1. The removal of a shoal at a place known as Accabee, about 8 miles above Charleston City, where, according to survey made in 1873, there was then only 9 feet of water at mean low tide; and

2. The removal of a shoal just below the Wando Phosphate Works, where only 6 feet of water was found at low tide.

During the fiscal year ending June 30, 1882, a channel of about 100 feet width and over 1,000 feet in length was cut by dredging through the shoal at the crossing near the Wando Works to a depth of 11 feet at mean low water. In doing this 13,558 cubic yards of material was removed. The channel excavated has thus far remained in good condition, but it is not at all certain that the depth of 11 feet will be maintained by the scouring power of the stream. Dredging from time to time will probably be necessary, unless the stream is contracted by suitable works. No estimates of the cost of such works are submitted by the Engineer officer in charge.

There are other shoals lower down where the channel requires deepening.

The total amount expended on this improvement to June 30, 1883, was $2,414.93.

July 1, 1882, amount available	$85 07
July 1, 1883, amount available	85 07
Amount (estimated) required for the completion of the existing project	2,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	2,500 00

(See Appendix L 5.)

6. *Savannah Harbor and River, Georgia.*—During the last fiscal year operations were carried on in conformity to the project submitted August 28, 1873, and the supplementary projects of March 19, 1879, and January 16, 1882.

The plan of improvement now in progress of execution contemplates

the establishment of a channel from Tybee Roads to the city of Savannah, navigable for vessels of 22 feet draught, and the widening of the river opposite to the city to 600 feet, of uniform depth with the balance of the channel.

This is to be accomplished by improving the north channel, in preference to the south channel, from the head of Elba Island to the head of Long Island; closing with dams all the lateral channels connecting the north and south channels from Elba Island to Tybee Roads; constructing a low dam across the south channel above Saint Augustine Creek, in order to increase the volume of ebb-flow down the north channel; raising the dam at the Cross Tides, 4 miles above the city of Savannah, to a higher level, possibly to the level of high water; narrowing the river between Savannah and Tybee Roads by wing-dams where the widths are excessive and the navigation poor; constructing a low jetty or training-wall from some point on either Jones or Turtle Island in a southeasterly direction to the Red Light Beacon; and protecting Saint Michael's Channel below that beacon by a similar wall. Works of shore protection will be built and dredging done wherever deemed necessary.

The estimated cost of the improvement, according to the plan submitted January 16, 1882, is $730,000.

Prior to July 1, 1882, the Cross-Tides Dam had been raised to the level of 3 feet above mean low water; a portion of the old King's Island jetty was removed; two substantial wing-dams were constructed opposite the lower part of the city, reducing the width of the water-way to 650 feet; a training-wall was built extending 5,000 feet down stream from the lower end of Fig Island, with its crest about 3 feet above low water; a submerged dam or sill was laid across the south channel near the head of Elba Island; three dams were constructed, closing the principal side channels below Elba Island; and dredging had been done at various places between the Cross-Tides Dam and Tybee Roads, aggregating 1,363,649 cubic yards. A number of wrecks and portions of wrecks, as well as piles, cribs, and other obstructions, were removed from the channel.

During the past fiscal year the low places in the Cross-Tides Dam were raised several feet by putting on 760 cubic yards of stone.

A third wing-dam, composed of several courses of log rafts and stone, was constructed at Garden Bank Shoal, opposite the lower part of the city, and 23,191 cubic yards of material was dredged from that shoal. The Fig Island Training-Wall, or jetty, on the north side of the new channel at "The Wrecks" was extended down stream 1,000 feet, and built up to the height of 2 to 3 feet above low water, like the older portion of the jetty. Eleven short spur jetties were added to this jetty on the channel side to narrow the water-way of the river still more. For the same purpose a spur jetty was built about 500 feet above the upper end of the Fig Island Jetty. Dredging to the amount of 83,180 cubic yards was done in the channel at "The Wrecks," giving a low-water channel of not less than 13 feet at the shoalest places.

The two side channels, one on either side of Barnwell Island, were closed by dams. A wing-dam was constructed opposite the head of Elba Island, and 29,084 cubic yards of material was dredged from the channel at "The Obstructions," a little above that wing-dam. The least low-water depth at this locality is 15 feet.

To contract the water-way in the upper portion of the north channel a wing dam was built at the lower end of Spirit Island, and one opposite to it. A pair of similar wing-dams was laid about 2,400 feet lower

down. The three closing dams below Elba Island, having settled since the end of the previous fiscal year, were again raised to a height of from 4½ to 5 feet above low water by riprap stone.

A total length of 8,935 linear feet of dams of all descriptions was built during the past fiscal year. For building these dams and for repairing older work there was used 73,669.7 square yards of log and brush mattresses, and 21,095 cubic yards of riprap stone. The material removed by dredging aggregated 135,456 cubic yards.

The system of improving Savannah Harbor and River, now in progress, was practically begun in 1874. In 1873 there were several reaches of the river of great extent, between the city and Tybee Roads, with only 10 feet of water at low tide, and one or two places with only about 9 feet.

There is now a practicable ship-channel on that whole route for vessels drawing more than 19 feet of water. Vessels drawing 19½ feet have passed from Savannah to Tybee Roads on a single tide.

During the present fiscal year the work will be continued with the balance on hand and in conformity to the project submitted January 16, 1882.

The total estimated cost of the work, under the three projects adopted since 1873 is $1,212,000. The appropriations made for this improvement since 1874 aggregated $682,000. The total expenditures from the beginning of work to June 30, 1883, have been $620,984.38.

July 1, 1882, amount available		$15,051 92
Amount appropriated by act passed August 2, 1882		200,000 00
		215,051 92
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$116,591 21	
July 1, 1883, outstanding liabilities	37,445 09	
		154,036 30
July 1, 1883, amount available		61,015 62
Amount (estimated) required for completion of existing project		530,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		530,000 00

(See Appendix L 6.)

7. *Savannah River, Georgia.*—By the river and harbor acts of March 3, 1881, and August 2, 1882, the aggregate sum of $40,000 was appropriated for this improvement. These appropriations were intended to be applied to the improvement of the Savannah River, between the cities of Augusta and Savannah, where at several places navigation was seriously obstructed during the dry season by extensive shoals or sand bars with only 2 or 3 feet of water over them, and at numerous other points by snags, floating and overhanging trees, and piles.

The plan of improvement contemplates the creation of a low-river channel of 5 feet depth over all shoals of less depth, and clearing the river of other obstructions to navigation. For these purposes wing-dams were to be built for narrowing the river where the widths are excessive; deposit of silt to be promoted along the banks by light hurdle works; caving banks revetted where necessary; projecting points to be cut away, snags and other obstructions to be removed, and dredging to be done where necessary to assist the formation of a low-water channel. The cost of the project is estimated at $91,000.

Prior to July 1, 1882, operations were confined to the construction of a snag-boat and the removal of piles, snags, and overhanging trees between Hack's Bar and Brier's creeks, 70 miles and 130 miles below

the city of Augusta, respectively. The expenses to that date were $14,924.82.

During the last fiscal year the operations consisted in improving Gardner's Bar and Course's Bar, situated opposite and just below the city of Augusta, and in removing snags and other other obstructions from other points of the river. Five wing-dams, composed of fascine mattresses covered with riprap stone, were built to improve Gardner's Bar; between their heads and the Georgia shore the width of the river, which formerly was 650 feet, is now reduced to 350 feet. The bluffy and caving banks on the Georgia side were strengthened at eight different points by revetting works of fascines and stones.

The improvement of Course's Bar was begun by constructing one wing-dam, and laying the foundation of two others. At the end of the past fiscal year it was found that 4 feet at low water could then be carried over the two bars named, where previously at no time more than from 2.4 to 3 feet of water existed. Where snags and other obstructions were removed by the snag-boat navigation was invariably improved.

The total expenditures from the beginning of the work to June 30, 1883, were $38,887.85.

With the small balance on hand July 1, 1883, it is proposed, during the present fiscal year, to remove snags and other obstructions by the United States snag-boat.

July 1, 1882, amount available		$75 18
Amount appropriated by act passed August 2, 1882		25,000 00
		25,075 18
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$17,660 18	
July 1, 1883, outstanding liabilities	6,302 85	
		23,963 03
July 1, 1883, amount available		1,112 15
Amount (estimated) required for completion of existing project		51,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		51,000 00

(See Appendix L 7.)

8. *Savannah River, above Augusta, Georgia.*—During the last fiscal year operations were carried on in general conformity to the first of two projects submitted by the engineer officer in charge, February 8, 1879, which contemplates the improvement of the river, for pole-boats only, from Augusta up to Trotter's Shoals, a distance of 64 miles. The cost of the project was estimated at $45,000. The obstruction to pole-boat navigation consisted chiefly in rock ledges running across the channel, bowlders of various sizes, and shoals of gravel. On many shoals there was but 1 or 2 feet of water during low-river stage.

The project is designed to create a clear channel of 30 feet width and 3 feet depth at low water.

Prior to July 1, 1882, the river was improved at a number of places between the city of Augusta and Trotter's Shoals, the larger portion of the work being done within 8 miles of the city. The expenditure to that date was $23,752.76.

During the past fiscal year, operations were carried on between Stevens's Creek Ledge, 8½ miles above Augusta, and Ring Jaw, 34 miles from that city. Several of the channels running across rock ledges and incumbered with bowlders were improved. A number of wing-dams, composed of brush mattresses, 18 inches thick, loaded with stone, were built; 6,670 square yards of mattresses, and 1,726 cubic yards of

stone, were used in their construction. The rock removed amounted to 439 cubic yards.

The work has thus far resulted in producing a low-river channel of a minimum width of 20 feet, and a minimum depth of 2½ feet from the city to Barksdale Ferry, a distance of 50 miles.

The appropriations made for this improvement aggregated $39,000. The total expenditures to July 1, 1883, were $36 604.41.

With the funds still on hand July 1, 1883, the work will be continued in conformity to the adopted project.

July 1, 1882, amount available		$247 24
Amount appropriated by act passed August 2, 1882		15,000 00
		15,247 24
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$8,471 53	
July 1, 1883, outstanding liabilities	4 380 12	
		12,851 65
July 1, 1883, amount available		2,395 59
Amount (estimated) required for completion of existing project		6,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		6,000 00

(See Appendix L 8.)

9. *Romerly Marsh, Georgia.*—By the river and harbor act passed August 2, 1882, the sum of $10,000 was appropriated for the improvement of Romerly Marsh, Georgia, by route designated as in "the survey of engineers as route numbered four." This is the first appropriation made by Congress for this work.

The water route through Romerly Marsh forms a part of the inland passage between the Savannah River, Georgia, and the Saint John's River, Florida. The marsh is situated between Wassau Sound on the north and Ossabaw Sound on the south.

The existing route is objectionable from its excessive crookedness and deficiency in depth of water. Vessels drawing 5 feet of water cannot pass through on less than half-tide.

In his report of an examination of Romerly Marsh, the engineer officer in charge described four different routes that might be adopted in preference to the existing passage. Either one of the lines suggested was designed and recommended to receive a low-water depth of not less than 7 feet on a bottom width of 48 feet.

Route No. 4 named in the act is the most easterly one of those examined and nearest to the ocean. By this route, Dead Man's Hammock Creek, which flows through the marsh and empties into Wassau Sound, is to be connected by a solid cut of about 1,160 yards' length with Wassau Creek, which flows into Odingsell River near the point where the latter discharges into Ossabaw Sound. The cost of establishing Route No. 4 was estimated at $38,720.

It was at first proposed that nothing should be done during the past fiscal year towards beginning operations inasmuch as the appropriation was entirely inadequate to open a cut through the marsh wide enough for steamboats.

In January, 1883, the Georgia and Florida Steamboat Company offered to add $5,000 to the appropriation to secure a beginning of the work, which offer was accepted.

At the end of the last fiscal year the cut had been carried 252 feet, with a low-water depth of 7 feet, a bottom width of 50 feet, and a width of 110 feet at the surface of the marsh.

During the present fiscal year the work will be continued with the funds remaining on hand on July 1, 1883.

It is desirable that an appropriation amounting to the full balance of the estimated cost be made at an early date, since the work will be of no benefit to commerce and navigation until the cut is completed.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$61 63	
July 1, 1883, outstanding liabilities	2,399 33	
		2,460 93
July 1, 1883, amount available		7,539 07
Amount (estimated) required for completion of existing project		24,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		24,000 00

(See Appendix L 9.)

10. *Brunswick Harbor, Georgia.*—During the past fiscal year operations have been carried on in general conformity to the project submitted by the engineer officer in charge April 29, 1876, modified in his annual report for the fiscal year ending June 30, 1880. That plan comprises the construction of a jetty starting from the northeasterly point of Buzzard's Island, and located approximately parallel to, and 1,000 feet distant from, the established pier-head line on the opposite shore, for the purpose of contracting the water-way and concentrating the current upon a shoal about 1 mile below the town of Brunswick. The bottom being hard and tough, expensive dredging has been necessary.

The object of these works is to establish and permanently maintain a channel not less than 15 feet deep at mean low tide, over the shoal upon which heretofore the navigable low-water depth was only 9 feet. The cost of the project is estimated at $73,187. This estimate does not include works that eventually may be needed at the upper end of East River, a loop of the main stream, on which Brunswick is situated.

The first appropriation for this locality was made in 1836, and amounted to $10,000. It was expended in dredging on the shoal referred to.

For carrying out the existing project four appropriations have been made, aggregating $60,000.

Prior to July 1, 1882, the following work was done: The main line of the jetty, or the jetty proper, had reached a length of 1,794 feet. The first length of 780 linear feet is formed of palmetto cribs filled with brush and with material obtained by dredging, and topped off with riprap stone. The ridge of the stone covering is a few feet below the low water line. The outward end of the work for a length of 1,014 linear feet is composed of double-raft mattresses covered with brush and riprap stone. At the upper end the jetty was connected with the shore by a return face formed of palmetto cribs, aggregating 310 feet in length. Up to the same date 52,018 cubic yards of material had been removed by dredging.

During the last fiscal year the jetty was extended a length of 2,405 linear feet, by means of double-raft mattresses covered with brush and riprap stone. The head or southern end of the jetty has reached the 18-foot low-water curve on the outer slope of the bar. For the greater part of its length the crest of this new work reaches to the low-water line, but near its end it gradually drops below that level. At the extreme end there is from 9 to 10 feet over it. The aggregate length of the jetty is now 4,199 feet, exclusive of the return face.

During the last fiscal year 28,484 cubic yards of material were dredged

on a line parallel to the jetty, and about 720 feet east of it. Up to the present time three cuts have been made through the shoal to a low-water depth of 15 feet. Each of these cuts is from 4,400 to 4,475 feet in length and from 20 to 25 feet in width. A fourth cut nearest to the Brunswick shore, of the same width, had reached a length of 1,750 feet, with 12 feet depth at low water.

The jetty work stands well. The deep cuts have shoaled at some points from 1.6 to 2.3 feet.

The engineer officer in charge states in his report that the original estimate for work below the city needs to be increased in consequence of the largely increased cost of dredging, and for other causes, and that the works at the upper end of Buzzard's Island, for which no estimate has heretofore been made, but for which a brief project is now submitted, will probably cost not far from $85,000, and he asks that $75,000 be appropriated for completing the existing project and commencing additional works above the city.

The appropriations made for this work aggregated $60,000. The total expenditures to June 30, 1883, were $59,501.10.

July 1, 1882, amount available	$1 47
Amount appropriated by act passed August 2, 1882	25,000 00
	25,001 47
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	24,502 57
July 1, 1883, amount available	498 90
Amount (estimated) required for completion of existing project, and for commencing additional works above the city of Brunswick	75,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	75,000 00

(See Appendix L 10.)

11. *Altamaha River, Georgia.*—By the river and harbor acts of March 3, 1881, and August 2, 1882, the aggregate sum of $20,000 was appropriated for improving this river.

The Altamaha is the most important river lying entirely within the State of Georgia. It is 155 miles long, from its source to the confluence of the Oconee and Ocmulgee, has a southeasterly course, and empties into the Atlantic Ocean through Altamaha Sound, below the town of Darien. It has been badly obstructed by rock ledges, sand bars, and snags; and the plan of improvement provides for their removal so as to secure a navigable low-river channel 80 feet wide and 3 feet deep, at an estimated cost of $60,000.

The first appropriation of $5,000, was expended in part payment for the construction of a snag-boat, the balance of the cost of the boat having been charged to the appropriations for the Savannah River, and Savannah River and Harbor.

Nothing was done during the past fiscal year beyond making a special examination of the river to select those points that should first be improved and concluding a contract for removing rock and building wing-dams in the upper portion of the river.

During the present fiscal year operations, which have been delayed by the unfavorable stage of the river, will be carried on, in conformity to the existing project.

The appropriations made for this improvement aggregate $20,000. The total expenditures to June 30, 1883, were $5,131.79.

July 1, 1882, amount available	$6 10
Amount appropriated by act passed August 2, 1882	15,000 00
	15,006 10
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	137 89
July 1, 1883, amount available	14,868 21
Amount (estimated) required for completion of existing project	40,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	40,000 00

(See Appendix L 11.)

12. *Entrance to Cumberland Sound, Georgia and Florida.*—During the last fiscal year operations have been carried on in general conformity to the plan described in general terms in a report of the engineer officer in charge, dated June 30, 1879, contained in Appendix I 8, Annual Report of the Chief of Engineers for 1879.

The project consists essentially of two low jetties, composed of riprap stone, resting on a broad foundation mattress of logs, or logs and brush, starting, respectively, from the opposite shores of the entrance and extending seaward across the bar upon lines so directed that the outer ends will be approximately parallel to each other, and from 3,000 to 3,500 feet apart, or such distance as may hereafter be adopted. The estimated cost of the improvement, with two long jetties, is $2,071,023. They are calculated to maintain a low-water depth across the bar of not less than 20 to 21 feet, or a high-water depth of 26 to 27 feet. If only one long jetty is built on the north side, with a spur jetty on the south side, the cost will not exceed about $1,000,000, and the low-water depth maintained will not, perhaps, exceed 16 to 17 feet. Heretofore the depth on the bar has not usually exceeded 13 to 13½ feet at mean low water, and at times has been as low as 11½ feet.

Prior to July 1, 1882, the foundation course of the north jetty, consisting of a log and brush mattress ballasted with riprap stone, had reached a point 7,372 feet from its shore end on Cumberland Island. Its width varies from 35 to 52 feet, and its thickness through log and brush from 19 to 22 inches. A second course of mattresses of similar thickness, from 20 to 25 feet width, covered with riprap stone, aggregating 1,366 feet in length, was laid upon the foundation course along the deeper portion of the Cumberland Channel.

The bottom course of the south jetty had been extended a length of 1,316 feet from the eastern shore of Amelia Island. Its construction is similar to that of the north jetty. The mattresses are about 21 inches thick and vary from 40 to 50 feet in width.

During the last fiscal year the second course of the north jetty was extended a length of 73 feet. The foundation mattresses for two spurs were laid on the south side of the jetty, at distances of 1,625 feet and 1,800 feet, respectively, from the high-water line on shore. Some low places in the jetty were brought to a greater height by deposits of riprap stone.

The foundation course of the south jetty was extended seaward 2,851 feet. The mattresses varied in width from 50 to 87 feet. The present seaward end has reached the deep-water pocket east of Amelia Island and rests in a low-water depth of 23 feet.

Both jetties have settled somewhat at a few places but to no serious extent; otherwise they are in a satisfactory condition. No benefit to navigation has as yet resulted from these works. They require to be very considerably extended and raised to a greater height before they can be expected to produce any changes on the bar.

The appropriations for this improvement aggregate $180,000. The total expenditures to June 30, 1883, amounted to $178,714.15.

July 1, 1882, amount available	$19,743 11
Amount appropriated by act passed August 2, 1882	50,000 00
	69,743 11
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	68,457 26
July 1, 1883, amount available	1,285 85
Amount (estimated) required for completion of existing project	1,891,023 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	600,000 00

(See Appendix L 12.)

13. *Saint John's River, Florida.*—During the fiscal year ending June 30, 1883, the work of improving the channel over the bar at the mouth of Saint John's River, Florida, was continued in conformity to the plan submitted by the engineer officer in charge June 30, 1879, printed in Appendix I 7, Annual Report of the Chief of Engineers, 1879.

The plan consists essentially in the construction of two low jetties, starting, respectively, from the opposite shore of the entrance, and so directed that the outer ends on the bar will be approximately parallel to and about 1,600 or 1,800 feet distance from each other, or such amended distance as shall hereafter be adopted.

By means of these works it is expected to maintain a practicable low-water depth of 15 feet upon the bar, where previously the navigable low-water depth has not usually exceeded 6 to 7 feet.

Up to June 30, 1882, the foundation-course of the north jetty had reached a length of 1,115 feet from the shore of Fort George Island. The mattresses forming that course were log rafts covered with brush or poles, overlaid with riprap stone. The mattresses varied from 19 to 22½ inches in thickness through log and brush or pole, and from 42 to 60 feet in width.

The foundation-course of the south jetty had been laid to an aggregate length of 4,813 feet, including a short branch or return face 874 feet in length. The work where it crosses the deeper part of the south channel had been raised higher by four additional courses of mattresses and riprap stone.

Eight spur-dikes, four on each side, were built against the south jetty to arrest the scour which seemed to threaten the stability of the work. These spurs were built in two courses.

The mattresses of the bottom course varied from 20 to 87 feet in width; those of each of the upper courses were about 8 feet narrower than those of the next course below. They were of the same description as the mattresses used on the north jetty.

On June 30, 1882, about 1,000 linear feet of the main line of the south jetty, next to the shore branch, reached up to the level of low water. The next adjoining length of 500 feet was about 1 foot lower, and the balance from 2 to 13½ feet below the level of low water. A length of about 300 feet had been left low enough for vessels to go over it without touching the main ship-channel now in use crossing the work at that place.

During the past fiscal year work was done on the south jetty only, and to a great extent with a view to insuring its safety. The scouring current along the sides of the jetty, observed during the preceding year, had greatly increased in strength, especially on the south side of the

work. At several points the under-scour caused considerable settlement of the jetty, on the main line as well as on the shore branch.

The danger from under-scour appearing to be greatest on the south side, an apron of reveting mats, varying from 40 to 60 feet in width, was laid along the south edge of the foundation-course of the jetty, beginning at low-water mark and extending 2,113 feet seaward. This apron was still further widened for a length of 1,509 feet where it was most needed by mattresses 40 feet in width. At the end of the fiscal year this additional apron was, therefore, 2,113 feet long, with widths varying from 40 to 100 feet. At the most important points the sunken part of the jetty was raised to a higher level by placing on it from one to three courses of mattresses of 30 feet width, covered with rip-rap stone, raising the work to a height varying from 3 feet to 9 and 10 feet. This operation extended a length of about 870 feet eastward from a point about 1,100 feet from the angle of junction of the jetty with the shore branch. One course of mattresses and stone, averaging 3 feet in thickness, covers the whole length of 870 feet; another course covers about 230 linear feet of the first course, adding 3 or 3½ feet to the thickness; and a third course of 125 feet length had been placed over a portion of the second course, for which length the sunken part of the jetty was raised an aggregate height of from 9 to 10 feet.

During the present fiscal year, with the balance on hand July 1, 1883, operations will be continued, and will consist in raising the south jetty, in extending the additional apron on its south side, and in laying a similar apron along the northern edge of the jetty.

The works thus far executed have as yet neither the requisite height nor length to create an improved ship-channel across the bar.

The appropriations for this improvement aggregate $375,000. The total expenditures to June 30, 1883, were $300,598.49.

In view of the present critical condition of the work, the engineer officer in charge earnestly recommends that the sum of $75,000 be appropriated for this work by a special act, said sum to be made available at an early date, so that operations can be resumed some time during the coming winter. There appears to be no doubt that the work will be left in a precarious condition when the balance of the last appropriation is expended under the existing contract.

July 1, 1882, amount available		$6,771 18
Amount appropriated by act passed August 2, 1882		150,000 00
		156,771 18
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$33,759 95	
July 1, 1883, outstanding liabilities	48,609 72	
		82,369 67
July 1, 1883, amount available		74,401 51
Amount (estimated) required for completion of existing project		931,409 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		600,000 00

(See Appendix L 13.)

14. *Volusia Bar, Florida.*—During the fiscal year ending June 30, 1883, the work of improving Volusia Bar, Florida, was continued in conformity to the project submitted by the engineer officer in charge, July 16, 1879, printed in Appendix I 9, Annual Report of the Chief of Engineers, 1879.

Volusia Bar is located at the southeast end of Lake George, about 162 miles from the mouth of the Saint John's River, at a point where the waters of the river discharge into the lake.

The plan of improvement comprises the construction of two converging brush and stone jetties, with a view of establishing and maintaining a channel 6 feet deep over this bar, where heretofore the low-river depth has occasionally not exceeded 3½ to 4 feet. The cost of the project was estimated at $15,000. Up to June 30, 1882, the west jetty had reached a length of 2,206 feet from shore. The east jetty was carried to a length of 1,836 feet from shore by brush-mattresses and stone. Its aggregate height was about 3 feet. Its crest, with few exceptions, projected from 1 to 2½ feet above low water.

One hundred and seven piles had been driven, of which one hundred were in clusters of three and four, in two rows 75 feet apart, through which space the boats had to pass in crossing the bar.

During the past fiscal year the east jetty was extended about 1,623 feet. Its outer end is now nearly abreast with that of the west jetty. The shore end of the east jetty is about 2,400 from that of the west jetty; it converges towards the latter, and is 240 feet from it on the bar. The width of its apron course varies from 6 to 12 feet. A second course of mattresses 6 feet wide was laid on its outer end for a length of 247 feet. The aggregate height of the extension is about 3 feet, except at the outer end, where it is over 5 feet.

Forty-three new fender piles were driven, and seventeen old piles that had been damaged were removed.

The appropriations for this improvement aggregate $15,500. The total expenditures to June 30, 1883, were $14,989.04.

The work has settled at some places, but is generally in good condition. The channel between the jetties has now a depth of from 4.7 to over 5 feet.

The engineer officer in charge states in his report that it will require some increase of his original estimate of $15,000 in order to secure the proposed low-water depth of 6 feet on Volusia Bar.

The jetties will require to be somewhat extended, and their outer portions will be higher and consume more material, being located in deeper water.

Some dredging will probably be needed, and neither this work nor the piles driven formed part of the original project. The work was also rendered more expensive, because the sum originally estimated to be required was furnished in three small appropriations. For these reasons an additional appropriation of $6,100 is asked.

July 1, 1882, amount available	$66 00
Amount appropriated by act passed August 2, 1882	5,000 00
	5,066 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4,555 04
July 1, 1883, amount available	510 96
Amount (estimated) required for completion of existing project	6,100 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	6,100 00

(See Appendix L 14.)

15. *Saint Augustine Creek (Thunderbolt River), Georgia.*—No work was done during the fiscal year ending June 30, 1883, and no appropriation is asked for.

July 1, 1882, amount available	$3,417 66
July 1, 1883, amount available	3,417 66

(See Appendix L 15.)

16. *Inside passage between Fernandina and Saint John's River, Florida.*—Work on this improvement was not resumed during the last fiscal year,

for the reason given by the engineer officer in charge that there seemed to be not only no urgent need for its continuance, but no prospect of securing any permanent improvement from the expenditure of small appropriations.

July 1, 1882, amount available	$4,434 45
July 1, 1883, amount available	4,434 45

(See Appendix L 16.)

17. *Removal of sunken vessels obstructing or endangering navigation.*—The wreck of the United States transport steamer Maple Leaf, referred to in the last annual report of the engineer officer in charge as forming an obstruction to navigation in Saint John's River, Florida, near Mandarin Point, 15 miles above Jacksonville, was removed during the past fiscal year to a low-water depth of 19 feet.

The work was done under the provisions of section 4 of the act of Congress approved June 14, 1880, and at a total cost of $3,972.79.

No further work is required at this place.

(See Appendix L 17.)

GULF OF MEXICO.

IMPROVEMENT OF THE HARBORS OF MOBILE, ALABAMA, AND KEY WEST AND PENSACOLA, FLORIDA; OF TAMPA AND APALACHICOLA BAYS, FLORIDA; AND OF CERTAIN RIVERS IN GEORGIA, ALABAMA, FLORIDA, AND MISSISSIPPI, EMPTYING INTO THE GULF OF MEXICO.

Officer in charge, Maj. A. N. Damrell, Corps of Engineers.

1. *Mobile Harbor, Alabama.*—The present project for the improvement of this harbor was adopted in March, 1880, the object being to afford a channel of entrance from the Gulf of Mexico to the city of Mobile, of 200 feet width, and not less than 17 feet depth at mean low water. The channel before was 200 feet wide through "Dog River Bar," and 300 feet wide through "Choctaw Pass Bar," with not more than 13 feet at the shoalest part, and was obtained by dredging under previous appropriations for 1870 to 1878, amounting in the aggregate to $401,000.

The amount expended to June 30, 1883, is $357,193.19, and has resulted in obtaining a channel not less than 17 feet deep at mean low water and 75 feet wide from the 17-foot curve in Mobile River to the curve of the same depth in the lower bay, 26.33 miles long; in the widening of this channel for a distance of 8.18 miles to not less than 105 feet; also that portion of the latter located in Choctaw Pass, 3,820 feet long to 145 feet width, and finally the sharp bend at the upper gap of the obstructions to a minimum width of 240 feet for a distance of 1,000 feet.

The amount available, and the amount asked for, is to be expended in widening the above channel, and it is expected that the combined amounts will complete the project adopted.

July 1, 1882, amount available		$115,276 28
Amount appropriated by act passed August 2, 1882		125,000 00
		240,276 28
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$147,469 47	
July 1, 1883, outstanding liabilities	3,070 29	
		150,539 76
July 1, 1883, amount available		89,736 52

Amount (estimated) required for completion of existing project.....	$420,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	420,000 00

(See Appendix M 1.)

2. *Pensacola Harbor, Florida.*—The present project for the improvement of this harbor was adopted in 1881, the object being to open a channel 300 feet wide and 24 feet deep at mean low water by dredging through a shoal which has formed inside the outer bar, and to construct such jetties and shore protections as may be necessary to prevent the further abrasion of the beach near Fort McRae on the western side of the entrance to the harbor, and maintain the dredged channel. The channel, when the project was adopted, had a depth of not more than 20 feet at the shoalest part at mean low tide.

The amount expended to June 30, 1882, is $73,025.53, and has resulted in stopping the abrasion of the beach, advancing it 120 feet at Fort McRae, and a less distance all along, from a point one-half mile north of the fort to the water battery on the south of it, and the partial dredging of one cut through the shoal above mentioned.

The amount available, and the appropriation asked for, are to be applied to continuing work on the jetties proposed and completing the dredging on the inner bar.

July 1, 1882, amount available		$51,859 34
Amount appropriated by act passed August 2, 1882.....		50,000 00
		101,859 34
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$34,884 87	
July 1, 1883, outstanding liabilities.....	669 75	
		35,554 62
July 1, 1883, amount available.....		66,304 72
Amount (estimated) required for completion of existing project		55,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		55,000 00

(See Appendix M 2.)

3. *Key West Harbor, Florida.*—The present project for the improvement of this harbor was adopted in 1882, the object being to afford a channel of entrance from the Gulf of Mexico into the "northwest" channel to Key West, so as to give a depth of 17 feet at mean low water.

The least depth on the bar on the "northwest" channel is 11 feet at mean low water, which is not sufficient for present commercial purposes. The principal object to be gained by the improvement is in the great saving in distance for all vessels plying between Key West and the Gulf ports. The amount expended to June 30, 1883, is $1,426.88.

No work was done during the year; but a contract has been entered into, the work to commence July 16, 1883. The amount expended was for preparations for the work. The amount available, and the appropriation asked for, is to be expended in dredging the projected channel; and it is expected that, although the full width and depth may not be obtained, the bids already received being nearly double what was estimated, still the object sought may be attained, and commerce fully relieved.

Amount appropriated by act passed August 2, 1882	$25,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882.....	1,426 88
July 1, 1883, amount available	23,573 12

Amount (estimated) required for completion of existing project	$115,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	115,000 00

(See Appendix M 3.)

4. *Chattahoochee River, Georgia and Alabama.*—The present project for the improvement of this river was adopted in 1873, the object being to afford a channel 100 feet wide and 4 feet deep at low water, from its mouth, near Chattahoochee, Georgia, up to Columbus, Georgia. The channel, before the improvement was commenced, was impassable at times between Columbus, Georgia, and Eufaula, Alabama, and the least depth on the bars varied from 1 to 3 feet. It was at other places narrow and dangerous from snags and rocks.

The amount expended to June 30, 1883, is $123,582.64 (estimated, as no separate account was kept of the expenditure for the Flint and Chattahoochee rivers, when the appropriation was made for both together) and has resulted in giving a fair navigable channel the whole year, except during exceptionally low stage of the river.

The amount available and the appropriation asked for are to be applied to continuing the improvement according to the approved project, and it is thought will complete it.

July 1, 1882, amount available	$16,789 90
Amount appropriated by act passed August 2, 1882	25,000 00
	41,789 90
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	15,372 54
July 1, 1883, amount available	26,417 36
Amount (estimated) required for completion of existing project	150,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	100,000 00

(See Appendix M 4.)

5. *Flint River, Georgia.*—The present project for the improvement of this river was adopted in 1873 and modified in 1880, the object of the original project being to afford a channel 100 feet wide and 3 feet deep at ordinary low water, from its mouth up to Albany, Georgia, and the modification to improve for high-water navigation that portion of the river between Albany and Montezuma, about 77 miles above. The channel before the improvement was commenced was only navigable at low water, from the mouth up to Bainbridge, and even that portion, was narrow, crooked, and dangerous.

The amount expended to June 30, 1883, is $83,728.47, and has resulted in securing a low-water channel 100 feet wide and 3 feet d[illegible] from the mouth up to Maples Chute, 60½ miles, and the improvement o[illegible] ver for high-water navigation from Swift Creek to within 4½ miles of Montezuma, an estimated distance of 55½ miles.

The amount available and the appropriation asked for are to be applied to continuing the work according to the project in both sections of the river, and it is expected that with the combined amounts the improvement can be so far advanced as to develop a large commerce on the river.

July 1, 1882, amount available	$2,797 21
Amount appropriated by act passed August 2, 1882	25,000 00
	27,797 21
July 1, 1883, amount expended during fiscal year, exclusive of out-standing liabilities July 1, 1882	16,525 68
July 1, 1883, amount available	11,271 53

Amount (estimated) required for completion of existing project.....$127,829 52
Amount that can be profitably expended in fiscal year ending June 30, 1885. 75,000 00

(See Appendix M 5.)

6. *Apalachicola River, Florida.*—The project for the improvement of this river was adopted in 1874, the object being to afford a channel of 6 feet depth and navigable width its whole length, avoiding the worst portion by utilizing Styx River and Moccasin Slough. The channel at that time had sufficient depth and generally sufficient width, but was obstructed by snags and overhanging trees, and the portion through Moccasin Slough was narrow, crooked, and difficult.

The amount expended to June 30, 1883, is $35,177.03 and has resulted in the complete execution of the project and, in addition, opening Chipola Cut-Off a distance of 9 miles, and removing yearly the accumulation of snags, &c.

The amount available and the appropriation asked for are to be applied to preserving the improvement and to widening the upper entrance of Moccasin Slough to render it easier of access.

July 1, 1882, amount available	$2,129 84
Amount appropriated by act passed August 2, 1882	2,000 00
	4,129 84
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	806 87
July 1, 1883, amount available	3,322 97
Amount (estimated) required for preservation of improvement annually	2,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	2,000 00

(See Appendix M 6.)

7. *Apalachicola Bay, Florida.*—The present project for this improvement was adopted in 1880, the object being to afford a channel of entrance from Apalachicola Bay into Apalachicola River, up to the wharves of the city of Apalachicola, 100 feet wide and 11 feet deep at mean low water. The channel, before the improvement was commenced, had a depth of 4 feet at the shoalest place.

The amount expended to June 30, 1883, is $44,342.06, and has resulted in securing a channel 75 feet wide from the 11-foot curve inside the bar to the 9½-foot curve on the outside, thereby increasing the depth available for commerce from 4 feet to 9½ feet at mean low water.

The amount available and the appropriation asked for are to be applied to extending and widening the cut already made, and will probably complete the improvement.

July 1, 1882, amount available		$94 95
Amount appropriated by act passed August 2, 1882		25,000 00
		25,094 95
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$22,227 56	
July 1, 1883, outstanding liabilities	2,209 34	
		24,436 90
July 1, 1883, amount available		658 05
Amount (estimated) required for completion of existing project		55,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		55,000 00

(See Appendix M 7.)

8. *Tampa Bay, Florida.*—The present project for the improvement of this harbor was adopted in 1880, the object being to afford a channel

from Tampa Bay, through the bar at the mouth of Hillsborough River, 150 feet wide and 9 feet deep at mean low water, and of the same depth and 200 feet wide up the river to the port of Tampa. The channel, before the improvement was commenced, had a depth in the shoalest place of not more than 5 feet.

The amount expended to June 30, 1883, is $20,000, and has resulted in securing a narrow channel of 9 feet depth, from the bay to the wharves of Tampa, with the exception of two small shoals extending from a point about 300 feet north of Spanish Town Creek to a point about 300 feet below the upper curve, a distance of about 1,000 feet, where there is now but 7½ feet.

The amount available and the appropriation asked for are to be applied to cutting through the shoals above mentioned and to widening the channel throughout, and the combined amounts are believed to be sufficient to complete the work.

Amount appropriated by act passed August 2, 1882	$20,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	20,000 00
Amount (estimated) required for completion of existing project	57,002 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	57,000 00

(See Appendix M 8.)

9. *Suwannee River, Florida.*—The present project for the improvement of this river was adopted in 1880, the object being to afford a channel of entrance through both East and West Passes, from Suwannee Bay into Suwannee River, of navigable width and of not less than 5 feet depth at mean low water, and to improve the river above so as to give a channel 50 feet wide, with a least depth of 4 feet, from Roland's Bluff up to Ellaville. Before the improvement was commenced the channel across the bar had a depth in the shoalest place of about 3 feet at mean low water; from inside the bar up to Roland's Bluff, there was a least depth of 5 feet, and from Roland's Bluff up to Ellaville a least depth of 1½ feet, and much obstructed with snags and overhanging trees.

The amount expended to June 30, 1883, is $8,210.33, and has resulted in securing a channel 65 feet wide, 6 feet deep, and 1,409 feet long.

No work was done during the last fiscal year, the contractor not being required to commence dredging till August 25, 1883.

The amount available and the appropriation asked for are to be expended in continuing the work according to the project, and it is expected will complete it.

July 1, 1882, amount available	$204 01
Amount appropriated by act passed August 2, 1882	5,000 00
	5,204 01
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	414 34
July 1, 1883, amount available	4,789 67
Amount (estimated) required for completion of existing project	42,158 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	42,200 00

(See Appendix M 9.)

10. *Choctawhatchee River, Alabama and Florida.*—The present project for the improvement of this river was adopted in 1872, the object being to improve the navigation by the removal of snags, wrecks, overhanging trees, and other obstructions, to accommodate the trade at that time between the mouth of Mitchell's River and Geneva. It was modified in 1880 so as to extend the improvement up to Newton, about 40 miles

above Geneva, for which an appropriation had been made, and to make a more thorough improvement of the river below Geneva, including the improvement of another mouth, or pass, called Cypress Top, having a little better water on the bar, to meet the wants of the rapidly increasing and changed character of the commerce on that portion of the river since the improvement was commenced.

The amount expended to June 30, 1883, is $47,840.04, and has resulted in the improvement of two passes, or mouths, of the river and the main river up to Clay Bank Creek, 220 miles, so that boats drawing 4½ feet can run at all times during an ordinary stage of river from the mouth up as far as Geneva, Ala., and boats drawing 2 feet from Geneva up to Clay Bank Creek. With a full river, 5 feet can be carried from the mouth to Clay Bank Creek safely. From the mouth up to Holmes Creek, 50 miles, 5 feet can be carried at the lowest stages of the river.

The amount available and the appropriation asked for are to be applied to extending the improvement up to Newton from Clay Bank Creek, 25 miles, to thoroughly improving that portion of the river between Geneva and the railroad station at Half Moon Bluff, so that boats drawing 4½ feet can safely run between those two points (40 miles) during the lowest stages of the water day or night, and will probably nearly complete the projected improvement.

July 1, 1883, amount available	$428 93
Amount appropriated by act passed August 2, 1882	*20,000 00
	20,428 93
July 1, 1882, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	11,268 97
July 1, 1883, amount available	9,159 96
Amount (estimated) required for completion of existing project	66,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	50,000 00

(See Appendix M 10.)

11. *Cahaba River, Alabama.*—The project for the improvement of this river was adopted in 1883, the object being to afford a channel over the lower portion of the river from its mouth up to the town of Centreville, a distance of 88 miles, with channel in open river 100 feet in width, with a least depth of 3 feet at low water, with a width in soft rock and bar cuts of 60 feet and a least depth of 3 feet at low water.

Before the improvement was commenced the condition of the river was such that it was extremely dangerous to navigation during high water, owing to the large number of overhanging trees, and the obstructions caused by the two fixed railroad bridges crossing the river, one at 8 and the other at 21 miles above its mouth. At low water the channel was so obstructed by snags, logs, sunken trees, rock shoals, gravel and sand bars, that navigation by either steamboat or flatboats was a matter of impossibility.

The amount expended to June 30, 1883, is $8,924.94, and has resulted in the complete improvement of 1½ miles of river above its mouth, and the partial improvement of 15¼ miles of the river on the lower portion, and in the direction of Centreville.

The amount available and the appropriation asked for are to be expended in continuing the improvement in accordance with the project adopted, which will complete the improvement for high-water navigation, and partially complete it for low-water navigation.

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*Two thousand dollars of this amount allotted to La Grange Bayou.

Amount appropriated by act passed August 2, 1882	$20,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	8,924 94
July 1, 1883, amount available	11,075 06
Amount (estimated) required for completion of existing project	175,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	100,000 00

(See Appendix M 11.)

12. *Tallapoosa River, Alabama.*—The project for the improvement of this river was adopted in 1883, the object being to afford a channel from the mouth of the river to the foot of Tallassee Reefs, 2 miles below Tallassee, the head of navigation, a distance of 48 miles, with channel in open river of 200 feet in width and a least depth of 3 feet at low water, with a width in soft rock cuts of 60 feet and a least depth of 3 feet at low water.

Up to the close of the fiscal year ending June 30, 1883, no funds have been expended on the improvement of this river, the water being so much above the low-water stage that it was not deemed advisable to commence the work.

The amount available and the appropriation asked for are to be applied in continuing the improvement upon the project adopted, and will probably complete the work.

Amount appropriated by act passed August 2, 1882	$15,000
July 1, 1883, amount available	15,000
Amount (estimated) required for completion of existing project	25,125
Amount that can be profitably expended in fiscal year ending June 30, 1885	25,000

(See Appendix M 12.)

13. *Old Town Creek, Mississippi.*—The project for this improvement, adopted in 1883, is to improve this stream for high-water navigation by the removal of snags, logs, and overhanging trees from its mouth to City Point, a distance of 30 miles.

An appropriation of $3,000 was made by act of August 2, 1882, for this improvement, but funds were not made available until March 1, 1883. Owing to the smallness of the appropriation it was deemed advisable to prosecute the work of improvement with outfit from the Tombigbee River above Columbus as soon as it could be spared. This fact, together with continued high water, prevented any work during the fiscal year.

The amount available and the amount asked for are to be expended on the work according to the approved plan, and will probably complete the work.

Amount appropriated by act passed August 2, 1882	$3,000
July, 1, 1883, amount available	3,000
Amount (estimated) required for completion of existing project	7,000
Amount that can be profitably expended in fiscal year ending June 30, 1885	7,000

(See Appendix M 13.)

14. *La Grange Bayou, Florida.*—The present project for the improvement of this bayou was adopted in 1882, the object being to deepen the channel through the bayou from its present depth of 3½ feet to 5 feet, to save vessels the detention they now meet with, often of several days at a time, waiting for high water. No expenditure has yet been made, the small appropriation of $2,000 not being sufficient to accomplish any good.

The amount available and the appropriation asked for are to be expended in dredging the channel above mentioned, and will probably complete the improvement.

Amount appropriated by act passed August 2, 1882	$2,000
July 1, 1883, amount available	2,000
Amount (estimated) required for completion of existing project	17,900
Amount that can be profitably expended in fiscal year ending June 30, 1885	18,000

(See Appendix M 14.)

15. *Withlacoochee River, Florida.*—The project for this improvement, adopted in 1881, is to improve the river by the removal of snags, loose rock, and overhanging trees, the deepening of some of the worst shoals, and of a bar near the mouth of the river, so as to enable boats drawing 2 feet of water to navigate the river during about half of the year. The least depth at present in the channel does not exceed 1 foot.

The amount expended to June 30, 1883, is $7,500, and has resulted in improving about 67 miles of the river.

The appropriation asked for is to be applied to continuing and completing the improvement.

Amount appropriated by act passed August 2, 1882	$3,931 63
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,931 63
Amount (estimated) required for completion of existing project	16,400 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	16,400 00

(See Appendix M 15.)

16. *Caloosahatchee River, Florida.*—The present project for the improvement of this river was adopted in 1882, the object being to so improve the river from the bar at the mouth up to Fort Meyer as to accommodate vessels of 6-foot draught.

The amount expended to June 30, 1883, is $3.59 for advertising.

A contract has been entered into for dredging on the bar at the mouth of river, but as the stipulated time for commencing the work was July 16, 1883, no work was done during the fiscal year.

The amount available and the appropriation asked for are to be applied to carrying on the work according to the project.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3 59
July 1, 1883, amount available	4,996 41
Amount (estimated) required for completion of existing project	15,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	15,000 00

(See Appendix M 16.)

17. *Peas Creek, Florida.*—The project for this improvement, adopted in 1881, is to improve this stream for high-water navigation by the removal of snags, overhanging trees, and loose rocks from the channel from its mouth to Fort Meade.

The amount expended to June 30, 1883, is $7,036.07, and has resulted in the improvement of about 36 miles of the river.

The amount available and the appropriation asked for, are to be applied to continuing the improvement of the river up towards Fort Meade, and it is thought will complete the improvement.

July 1, 1882, amount available	$4,576 67
Amount appropriated by act passed August 2, 1882	4,000 00
	8,576 67
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4,512 84
July, 1, 1883, amount available	4,063 83

Amount (estimated) required for completion of existing project.....	$5,700 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	5,700 00

(See Appendix M 17.)

18. *Escambia River, Florida.*—The project for this improvement was adopted in 1880, the object being to afford a channel of entrance from Escambia Bay into Escambia River of 150 feet width and 5½ feet depth at mean low-water, and to improve the river above to the Alabama and Florida State line. The least depth on the bar at the mouth of the river before the improvement was commenced was 1.9 feet; the river above had sufficient depth and width, but was obstructed by snags and log booms.

The amount expended to June 30, 1883, is $13,000, and has resulted in securing a channel 100 feet wide and 5½ feet deep through the bar at the mouth of the river, thereby facilitating the towage of lumber rafts from Ferry Pass to the head of the bay, previously dependent upon the tides for movement.

The appropriation asked for is to be applied to improving the river by the removal of overhanging trees and snags, and the construction of dams and bank protections, and it is expected will complete the improvement.

July 1, 1882, amount available.....	$3,360 43
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,360 43
Amount (estimated) required for completion of existing project.....	6,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	6,000 00

(See Appendix M 18.)

19. *Escambia and Conecuh rivers, Florida and Alabama.*—The project for the improvement of the Conecuh River was adopted in 1882, and is to improve the river from the Florida line up to Indian Creek by the removal of snags and overhanging trees, closing cut-offs by dams and cutting through rock shoals by blasting, to facilitate the transportation of lumber.

The river in its present condition is not navigable for boats, and even the transportation of timber and saw-logs is difficult in high water.

The amount expended to June 30, 1883, is $3,377.94, and has resulted in the improvement of about 4 miles of the river just above Brewton, Ala.

The amount available and the appropriation asked for are to be applied to continuing the improvement according to the project.

Amount appropriated by act passed August 2, 1882	$12,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,377 94
July 1, 1883, amount available.....	8,622 06
Amount (estimated) required for completion of existing project.....	50,430 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	25,000 00

(See Appendix M 19.)

20. *Alabama River, Alabama.*—The project for the improvement of this river was adopted in 1876, the object being to afford a channel 200 feet wide and 4 feet deep at low water from its mouth, 50 miles above Mobile, to Wetumpka, Alabama. The channel before the improvement was commenced had sufficient width, but a least depth of about 2 feet on some of the shoals, and was badly obstructed by snags and overhanging trees.

The amount expended to June 30, 1883, is $109,392.61, and has resulted,

by clearing the river of all dangerous snags and overhanging trees and the improvement of the worst bars, in opening 20 miles of the river below the "Cut-Off," before inaccessible during low water, in increased safety to navigation, greater regularity and reduction in time of trips between Montgomery and Mobile, and enabling steamboats to carry larger loads.

The amount available and the appropriation asked for are to be applied to keeping the river free from snags and overhanging trees, keeping jetties and dams already constructed in repair, and improving as many of the remaining bars, having less than the projected depth of water, as possible.

July 1, 1882, amount available	$6,098 47
Amount appropriated by act passed August 2, 1882	20,000 00
	26,098 47
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	15,491 08
July 1, 1883, amount available	10,607 39
Amount (estimated) required for completion of existing project	109,741 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	50,000 00

(See Appendix M 20.)

21. *Warrior and Tombigbee rivers, Alabama and Mississippi.—a. Tombigbee River, below Columbus, Mississippi and Alabama.*—The present project for the improvement of this section of the river was adopted in 1871 and modified in 1879, the object being to afford a low-water channel of navigable width and 4 feet depth from its mouth up to Demopolis, and of not less than 3 feet depth from Demopolis up to Columbus. Before the improvement was commenced this section of the river was navigable at low water practically for regular business only 95 miles of its 366 miles of length.

b. Warrior River, Alabama.—The present project for the improvement of this river was adopted in 1875, the object being to afford a channel 80 feet wide and 4 feet deep at low water from its junction with the Tombigbee up to Tuscaloosa. The channel at that time was not navigable at low water.

The amount expended to June 30, 1883, is $180,183.41 for both rivers, and has resulted in extending low-water navigation for light-draught boats 221 miles, has added two or three months to the length of the boating season on the remainder, has reduced the time required to make trips materially, and facility and safety to navigate have been greatly increased. The improvement is about half completed.

The amount available and the appropriation asked for are to be applied to removing snags and overhanging trees, protecting caving banks, improving the worst bars by means of brush jetties, and it is expected will complete the improvement.

July 1, 1882, amount available	$7,932 69
Amount appropriated by act passed August 2, 1882	30,000 00
	37,932 69
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	28,116 10
July 1, 1883, amount available	9,816 59
Amount (estimated) required for completion of existing project	148,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	148,000 00

(See Appendix M 21.)

22. *Tombigbee River, above Columbus, Mississippi.*—The present project for the improvement of this portion of the river was adopted in 1873, the object being to give good high-water navigation from Columbus, Miss., to Fulton, Miss., by the removal of snags and overhanging trees. The channel, before improvement, was not navigable at all from Fulton down to Cotton-Gin Port; from Cotton-Gin Port to Aberdeen, about 35 miles, it was navigable only for small barges carrying about 125 bales of cotton; from Aberdeen down to Columbus, about 65 miles, navigation was difficult when the water was 12 feet above ordinary low water.

The project may be considered to be acomplished, as there is now easy navigation, for steamers of 300 tons, from Columbus up to Aberdeen when the water is 4 feet above ordinary low water, and Aberdeen up to Fulton when it is 10 feet above. The amount expended to June 30 1883, for accomplishing and maintaining the improvement is $31,840.21.

The improvement is not permanent, but will require about $2,000 annually to keep the channel in its improved condition.

July 1, 1882, amount available	$4,373 40
Amount appropriated by act passed August 2, 1882	1,000 00
	5,373 40
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities, July 1, 1882	4,548 56
July 1, 1883, amount available	824 84
Amount (estimated) required for preserving improvement	2,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	2,000 00

(See Appendix M 22.)

23. *Noxubee River, Mississippi.*—The present project for the improvement of this river was adopted in 1880, the object being to afford a channel for small river steamers from its mouth up to Macon, Miss., of navigable depth and width during about nine months of the year, when the water is above the ordinary low-water stage. Before the improvement was commenced the channel was navigable for steamboats only after a considerable rise, and then only for a short distance above its mouth.

The amount expended to June 30, 1883, is $29,355.19, and has resulted in clearing the river of all overhanging trees, and in making a navigable high-water channel from its mouth up to Macon, Miss., the entire distance contemplated for improvement in the project adopted. Advantage has already been taken of the partial improvement of the river, steamboats having made several successful trips during the last high-water season.

The amount available and the appropriation asked for are to be applied to continuing the improvement in accordance with the project adopted, and will probably complete the work.

July 1, 1882, amount available	$1 55
Amount appropriated by act passed August 2, 1882	10,000 00
	10,001 55
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	9,356 24
July 1, 1883, amount available	645 31
Amount (estimated) required for completion of existing project	35,245 25
Amount that can be profitably expended in fiscal year ending June 30, 1885	25,000 00

(See Appendix M 23.)

24. *Pascagoula River, Mississippi.*—The present project for the improvement of this river was adopted in 1880, the object being to afford a channel 200 feet wide and 7 feet deep at mean low water from Mississippi Sound into East Pascagoula River, and to improve the river above by the removal of snags and overhanging trees. The channel before the commencement of the improvement had a depth of not more than 3 feet at mean low water at its shoalest part.

The amount expended to June 30, 1883, is $52,641.69, and has resulted in securing a channel 180 feet wide and 7 feet deep at mean low water from Mississippi Sound into Pascagoula River, and the improvement of the river above for a distance of 58 miles.

The balance available and the appropriation asked for are to be applied to continuing the improvement up the river, and it is expected will complete the project.

July 1, 1882, amount available	$2,345 72
Amount appropriated by act passed August 2, 1882	8,000 00
	10,345 72
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	6,987 41
July 1, 1883, amount available	3,358 31
Amount (estimated) required for completion of existing project	10,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	10,000 00

(See Appendix M 24.)

25. *Manatee River, Florida.*—The present project for the improvement of this river was adopted in 1882, the object being to afford a channel of entrance from Tampa Bay into Manatee River, so as to give a depth of 13 feet at mean low water from Tampa Bay up the river to Shaw's and McNeil's Points.

The least depth on the bar at the mouth of the river before the improvement was 8 feet at mean low water, not sufficient for the class of vessels engaged in the commerce between the river and outside ports.

The amount expended to June 30, 1883, is $3,038.99, but no results of consequence have been gained. The contractor's machinery broke down, and as there were no facilities for repair, he was allowed to suspend operations.

The amount available and the appropriation asked for are to be applied to a continuation of the dredging according to the project, and it is believed the combined amount will complete the project.

Amount appropriated by act passed August 2, 1882		$12,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,038 99	
July 1, 1883, outstanding liabilities	176 23	
		3,215 22
July 1, 1883, amount available		8,784 78
Amount (estimated) required for completion of existing project		58,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		58,000 00

(See Appendix M 25.)

26. *Roadstead leading into Back Bay of Biloxi, Mississippi.*—No project has been adopted for the improvement of this roadstead, the amount appropriated being deemed insufficient for an economical prosecution of the work.

The amount available and the appropriation asked for are to be ap-

plied to deepening the channel through Deer Flats to a depth of 8 feet, and the combined amounts will probably complete the improvement.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	11 45
July 1, 1883, amount available	4,988 55
Amount (estimated) required for completion of existing project	30,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	30,000 00

(See Appendix M 26.)

INSPECTION OF THE IMPROVEMENT AT THE SOUTH PASS OF THE MISSISSIPPI RIVER.

Inspecting officer, Capt. W. H. Heuer, Corps of Engineers.

Examination and surveys to ascertain the depths of water and widths of channel secured and maintained from time to time by James B. Eads, at South Pass of the Mississippi River.—The inspecting, officer in his annual report dated July 23, 1883, states that during the year, except for five days in July, 1882, there has been a 30-foot-deep channel between the jetties and extending into the Gulf; that this channel now has a least width of 90 feet; that a 26-foot-deep channel having a least width of 200 feet was maintained through the jetties during the entire year, excepting for nine days in July, 1882, when the channel did not have the required width; that there is now a practicable channel 27 feet in depth from the Gulf into the river proper through the pass, and that the least width of the 26-foot-deep channel anywhere in the pass is now 160 feet.

Only seventeen days' dredging has been done within the year.

An interior jetty 6,810 feet long has been built 200 feet inside of the east jetty and parallel to it. This has improved the depth and width of channel within the jetties and slightly beyond their ends, and has narrowed the width of available water-way between the jetties to 630 feet; this was originally about 1,000 feet in width.

A cyclone in September, 1882, damaged the east jetty wall considerably; the damage has not been repaired, and may not become necessary, as the inner jetty protects the channel from injury. No change of any importance has occurred in the fan-shaped area just beyond the ends of the jetties.

In the pass eleven new wing-dams were built with a view to make the pass narrower in its wider parts and to concentrate the current and produce a scour on some shoals which were becoming troublesome. The result was that the depth of water on the shoals increased very rapidly from 26 to 32 feet.

The surveys of 1882 compared with those of 1875 show a very considerable shoaling throughout the greater part of the pass, and illustrate the immense scour which the jetties produced on the old bar and vicinity.

The channel at the head of the pass is improving; it now is 30 feet deep and 400 feet wide.

Several vessels have been aground in the pass and in and near the jetties, but in every instance they were outside of the deep channel.

Attention is invited to the fact that Congress requires examinations and surveys to ascertain depths of water and widths of channels maintained at South Pass, &c., but has made no provision for the fiscal year ending June 30, 1884.

The amount of money available for this purpose on June 30, 1883, to continue the examinations and surveys, is only $6,048.94, barely sufficient to continue this work until December 31, 1883.

July 1, 1882, amount available	$6,239 44
Amount appropriated by act passed August 2, 1882	10,000 00
	16,239 44
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	10,190 50
July 1, 1883, amount available	6,048 94
Amount required for fiscal year ending June 30, 1884	6,000 00
Amount required for fiscal year ending June 30, 1885	17,500 00

(See Appendix N.)

IMPROVEMENT OF SABINE PASS AND BLUE BUCK BAR, AND OF SABINE AND NECHES RIVERS, TEXAS.

Officer in charge, Capt. W. H. Heuer, Corps of Engineers.

1. *Sabine Pass and Blue Buck Bar, Texas.*—The object of the improvement at Sabine Pass is to obtain deep water over the bar at the entrance, and thus secure an outlet for the products of Texas and Western Louisiana. In 1878 a channel was dredged over the bar, but was not self-maintaining; a second channel was afterwards dredged with like results. Experiment proved that dredged channels could not be maintained except by constant dredging at heavy expense. After a complete survey of the pass and a study of the tides, currents, and all physical data available, the question of obtaining a channel by the construction of jetties was considered. A report, project, and estimate was made, referred to the Board of Engineers for Fortifications and River and Harbor Improvements, and was transmitted to Congress March 28, 1882, and printed as House Ex. Doc. No. 147, Forty-seventh Congress, first session.

The improvement by the proposed plan was estimated to cost a little over $3,000,000, and contemplated the construction of two jetties, each nearly 4 miles in length, to concentrate and direct the tidal currents and thus produce a scour sufficient to produce a channel, and when obtained to maintain it.

On August 2, 1882, Congress appropriated $150,000 for this work. This together with funds left over from former appropriations ($151,296), made an aggregate amount of about $300,000, and warranted a commencement of the work under the new project.

In October, 1882, after due advertisement, the work was contracted for, and has since been pushed by the contractor at a cost to the United States of $2.25 per cubic yard for brush and $3.90 per gross ton of rock in place in the jetty. As the plant necessary to properly do this work was estimated to cost about $50,000, the contractors were allowed from October to January to get this plant ready and were required to commence building the jetty early in January, and to finish their contract by December 1, 1883, or sooner if practicable. Their contract called for $290,000 worth of jetty in place, the other $10,000 being withheld for engineering expenses, for preservation and protection of work, and for experimental purposes, with a view to reducing the cost of subsequent work.

The west jetty was commenced in January, 1883, and though the weather since has been unusually stormy, the progress has been quite satisfactory, and has resulted in building the foundation of 11,600 feet of jetty, or a little over 2 miles in length. This has carried the jetty from the shore to just beyond the outer crest of the bar. The jetty varies in width from 15 to 60 feet, depending upon the depth of water in which it is located and its exposure to the sea.

Thus far no increased depth of water has obtained, and none was expected; it is yet too soon to expect any favorable results. An immense mud deposit has formed between the jetty and the shore, and the mats soon after sinking also become filled with mud. These indications are even more favorable than were expected; they insure the stability of the work. Within the past six months nearly $150,000 worth of jetty was built. The funds available will probably carry the work along till December 1, 1883, after which work will have to stop until further appropriations are made. The officer in charge estimates that $600,000 can be profitably expended in the fiscal year ending June 30, 1885, and with that amount of money produce decided results on the bar, and he estimates that with 14 feet depth of water on the bar, which he thinks can be obtained by this amount of money, the value of the lumber alone passing through this channel in one year will exceed ten times the total value of commerce now passing over it. The collector at Sabine Pass estimates the value of commerce using this channel during the past year at $95,255. It is also certain that the work can be completed for much less than the original estimates.

July 1, 1882, amount available		$151,296 06
Amount appropriated by act passed August 2, 1882		150,000 00
		301,296 06
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$133,960 47	
July 1, 1883, outstanding liabilities	14,413 36	
		148,373 83
July 1, 1883, amount available (under contract)		152,922 23
Amount (estimated) required for completion of existing project (subject to material reduction)		2,876,310 41
Amount that can be profitably expended in fiscal year ending June 30, 1885		600,000 00

(See Appendix O 1.)

2. *Sabine River, Texas.*—Previous to improvement this river had 3½ feet depth on its bar. The project for improvement was to deepen the water on the bar, remove logs, snags, overhanging trees on banks, and generally improve the navigation so as to admit vessels drawing 5 feet of water. During the present fiscal year a channel was dredged over the bar at the mouth of the river 6 feet deep and 100 feet wide, requiring the removal of 29,832 cubic yards of material at a cost of $11,258.52.

There has thus far been appropriated for the improvement of the river $32,000, of which $27,453.43 has been expended.

The river is not susceptible of permanent improvement, and is now in a condition to meet the probable requirements of commerce for several years in the future.

July 1, 1882, amount available		$11,805 09
Amount appropriated by act passed August 2, 1882		4,000 00
		15,805 09
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		11,258 52
July 1, 1883, amount available		4,546 57

Nothing further required at present.

(See Appendix O 2.)

3. *Neches River, Texas.*—Before improvement the bar at mouth of river had 2½ feet depth of water; this was increased by dredging in 1880 to 5 feet, and the channel made from 30 to 60 feet wide. Logs, snags, and overhanging trees were removed up to Bevilsport, the head

of high-water navigation. High-water navigation, it is thought, cannot be further improved except by removing snags and logs occasionally, as they may interfere with steamboats. The bar at the mouth of the river has again shoaled to 3½ feet depth; to obtain a 5-foot deep channel 100 feet wide over this bar it is estimated will cost about $12,000, of which $5,156.85 is now available. The original estimated cost of improvement of the river was $41,318.05, of which $20,843.15 has thus far been expended. The work is not susceptible of permanent completion by dredging alone.

July 1, 1882, amount available		$281 44
Amount appropriated by act passed August 2, 1882		5,000 00
		5,281 44
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882 (surveys)		124 59
July 1, 1883, amount available		5,156 85
Amount required in addition to above for fiscal year ending June 30, 1885.		7,000 00

(See Appendix O 3.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE STATE OF TEXAS.

Officer in charge, Maj. S. M. Mansfield, Corps of Engineers, having under his immediate orders Lieut. W. L. Fisk, Corps of Engineers.

1. *Entrance to Galveston Harbor, Texas.*—The work of improvement projected in 1874 has had for its object the deepening of the inner and outer bars, by contracting the outflowing current upon a less extent of bar, to thereby effect its removal and prevent for some time to come its reformation.

The amount expended to June 30, 1883, $1,369,759.23, of which $853,898.93 (not including $14,174.26 of funds of the city of Galveston) was expended under the project of 1880, has been applied to constructing jetties, &c., and has resulted in obtaining and maintaining a good channel over the inner bar and a decided improvement in depth over the outer bar.

The *south jetty*, as constructed to June 30, 1883, comprehends:

A foundation-course 22,551 feet long, varying in width from 60 to 120 feet, and upon which is carried a second course, 15 to 30 feet wide, for nearly the same length. Superposed thereon are third and fourth courses; the third course, approximately, 12,500 feet and the fourth course (top) 4,000 feet in length. This practically completes the work for a distance of two miles from the shore end and 4,000 feet in from the outer end. A distance between of about 6,000 feet remains to be raised near to the water surface by the addition of a third and fourth course of mattresses.

The estimated amount required for the entire and permanent completion of the work of improvement, in accordance with the approved and adopted project, is $1,000,813.

Amount appropriated by act passed August 2, 1882		$300,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$257,249 88	
July 1, 1883, outstanding liabilities	10,509 35	
		267,759 23
July 1, 1883, amount available		32,240 77
Amount (estimated) required for completion of existing project		1,000,813 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		500,000 00

(See Appendix P 1.)

2. *Ship-channel in Galveston Bay, Texas.*—The project for improvement (adopted in 1871, modified in 1877) proposed the deepening and widening of the channel from the head of Bolivar Channel to the cut through Morgan's Point, to afford a channel for navigation 12 feet deep at mean low tide, with a width at bottom of 100 feet. The natural channel had a depth of not more than 7 feet at the shoalest places.

The amount expended to June 30, 1882 (appropriations from 1875 to 1880), was $173,174.04, which amount secured a navigable channel from the Gulf to the upper bay with a depth of not less than 9 feet.

During the year ending June 30, 1883, there was expended $113.455.46 (including outstanding liabilities July 1, 1882), which was applied to deepening the channel in the upper bay, between Red Fish Bar and Morgan's Point. From July 1, 1882, to June 1, 1883, there was excavated and removed from the channel-way an amount of material equal to 801,789 cubic yards, giving an average depth of 13 feet from Red Fish Bar to Morgan's Cut through the upper bay.

The officer in charge having submitted a report, detailing the record of the work from 1871, adding, in review of the record, that he was not able to submit a project for the reason that he could not recommend the expenditure of the money, $144,500 available, *in dredging* in this open bay, and asking instructions. The subject being important was referred to the Board of Engineer Officers specially appointed for the purpose of considering and reporting upon the best method to be adopted for further prosecution of work in connection with the dredged channel through Galveston Bay.

The recommendation of this office, as indorsed upon the proceedings of the Board, was that none of the funds then available (beyond what was needed to cover the contract existing) for this improvement should be expended until the further action of Congress was had thereon, and that the matter be made the subject of a special communication to Congress at its next session. This recommendation was based upon facts given in the report of the Board, it appearing that the improvement could not be made a permanent one at any reasonable cost; that the cost of maintenance would be about $90,000 per annum, and that the necessity for the channel was far less than formerly, and that it was not called for in the present interests of commerce.

The recommendation received the approval of the Secretary of War, and the officer in charge was so instructed.

The funds appropriated in 1881–'82, $144,500, are held in reserve, awaiting Congressional action.

July 1, 1882, amount available	$88,466 13
Amount appropriated by act passed August 2, 1882	94,500 00
	182,966 13
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	23,095 63
July 1, 1883, amount available	159,870 50

(See Appendix P 2.)

3. *Trinity River, Texas.*—The project (adopted in 1871, modified in 1873) had for its object the opening of the river to navigation so as to admit the entrance of vessels drawing 5 feet. The natural channel at the mouth of the river was shoal (4½ feet) and extremely narrow across the bar.

The amount expended to June 30, 1882, was $19,869.09, by which was gained a channel of entrance over the bar at the mouth of at least 5 feet depth, which depth was available for navigation from the mouth of the river to Liberty.

No work was done in the year ending June 30, 1883, the improvement made in former years appearing to be all sufficient.

The project for expending the funds in hand ($14,630.91) is held for future consideration. If dredging, snagging, &c., be required at any time during the year, it is thought the funds available will be ample to meet such demands.

The officer in charge makes no estimate of the money required for the fiscal year ending June 30, 1885.

The work is not susceptible of permanent completion.

July 1, 1882, amount available	$6,630 91
Amount appropriated by act passed August 2, 1882	8,000 00
	14,630 91
July 1, 1883, amount available	14,630 91
Amount (estimated) required for the completion of existing project	14,541 00

(See Appendix P 3.)

4. *Buffalo Bayou, Texas.*—The project adopted in 1880 proposed the opening up of the channel between Simms and White Oak bayous for commercial purposes. The original channel-way below Houston in 1880 was navigable for vessels drawing 6 feet of water. An estimate of $385,299.75 for a channel 12 feet deep and 100 feet wide, and for snagging, removing obstructions to navigation, &c., was made and incorporated in the approved project.

The amount expended to June 30, 1882, was $5,684.18, which gave observable good results.

During the year ending June 30, 1883, $48,072.75 (including outstanding liabilities July 1, 1882) was expended in dredging, snagging, clearing banks of overhanging trees, underbrush, &c., as was found necessary in developing the channel required. The available funds will be exhausted by the 1st of September under existing contract.

One hundred thousand dollars can be profitably expended in the fiscal year ending June 30, 1885, in deepening and enlarging the present channel to the advantage of commercial interests.

July 1, 1882, amount available		$860 98
Amount appropriated by act passed August 2, 1882		50,000 00
		50,860 98
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$22,937 99	
July 1, 1883, outstanding liabilities	24,762 17	
		47,700 16
July 1, 1883, amount available		3,160 82
Amount (estimated) required for completion of existing project		310,299 75
Amount that can be profitably expended in fiscal year ending June 30, 1885		100,000 00

(See Appendix P 4.)

5. *Channel over the bar at mouth of Brazos River, Texas.*—The natural channel across the bar afforded a depth of not over 8 feet, being subject to changes due to winds, tide, and stages of water in the river.

The adopted project of 1880 for this improvement has for its object the maintenance of a good navigable channel across the bar. The amount expended to the close of the fiscal year ending June 30, 1883, $128,490.01, has been applied to constructing jetties, with resulting good effect upon the bar channel.

One hundred thousand dollars can be profitably expended in the fiscal year ending June 30, 1885, in continuing work upon the jetties.

July 1, 1882, amount available	$2,240 97
Amount appropriated by act passed August 2, 1882	50,000 00
	52,240 97
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	50,730 98
July 1, 1883, amount available	1,509 99
Amount (estimated) required for completion of existing project	392,890 44
Amount that can be profitably expended in fiscal year ending June 30, 1885	100,000 00

(See Appendix P 5.)

6. *Pass Cavallo Inlet to Matagorda Bay, Texas.*—The project adopted in 1879 has for its object the obtaining of a 12-foot channel across the bar and the protection of the head of Matagorda Island from abrasion.

The amount expended to the close of the fiscal year ending June 30, 1883, $172,318.65, has been applied to jetty construction, viz, the extension and building up of a south jetty. Any effect of this jetty upon the bar channel can only be attained after the jetty assumes larger proportions.

Two hundred thousand dollars can be profitably expended during the year ending June 30, 1885, in continuing work on the south jetty.

July 1, 1882, amount available	$5,000 00
Amount appropriated by act passed August 2, 1882	60,000 00
	65,000 00
July 1, 1883, outstanding liabilities	60,000 00
July 1, 1883, amount available	5,000 00
Amount (estimated) required for completion of existing project	799,280 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	200,000 00

(See Appendix B 6.)

7. *Aransas Pass and Bay up to Rockport and Corpus Christi, Texas.*—The project adopted in 1879 has for its object the maintenance of a 12-foot (at mean low water) channel over the bar and the protection of the head of Mustang Island up to and beyond Turtle Cove.

The channel across the bar was maintained at from 7 to 8 feet by natural causes.

The amount expended to June 30, 1883, $243,628.84, has been applied to the building of a number of groin-jetties for the protection of the head of Mustang Island up to and beyond Turtle Cove, in conjunction with a mattress and stone revetment along the channel-face of Mustang Island, and the partial construction of the south channel jetty.

The officer in charge renews his recommendation of last year, viz, for sufficient funds to complete south jetty, and to commence and hasten the development of the interior channels, to accommodate shipping up to the wharves at Corpus Christi and Rockport.

Four hundred thousand dollars can be very profitably expended in the fiscal year ending June 30, 1885, in constructing jetty at the pass and improving interior channels.

July 1, 1882, amount available		$448 53
Amount appropriated by act passed August 2, 1882		100,000 00
		100,448 53
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$62,021 61	
July 1, 1883, outstanding liabilities	36,371 16	
		98,392 77
July 1, 1883, amount available		2,055 76

Amount (estimated) required for completion of existing project.....$920,722 75
Amount that can be profitably expended in fiscal year ending June 30, 1885. 400,000 00

(See Appendix P 7.)

8. *Harbor at Brazos Santiago, Texas.*—The project of 1881 (only partly adopted) has for its object the deepening of its channel across the bar and the maintenance of a suitable harbor inside the pass.

Seven and one-half feet at high tide was the depth of water over the bar maintained by natural causes alone.

The amount expended to June 30, 1883, $58,830.91, has been applied to the building of a south jetty. The funds ($60,000) available will perhaps complete this jetty; and the officer in charge expects, as a result, a greatly improved channel of entrance.

Two hundred thousand dollars can be profitably expended during the year ending June 30, 1885, in constructing works at the pass and in the lagoon, as may hereafter be projected and adopted.

July 1, 1882, amount available		$3,210 75
Amount appropriated by act passed August 2, 1882		60,000 00
		63,210 75
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,060 75	
July 1, 1883, outstanding liabilities	150 00	
		3,210 75
July 1, 1883, amount available		60,000 00
Amount (estimated) required for completion of existing project		518,084 50
Amount that can be profitably expended in fiscal year ending June 30, 1885.		200,000 00

(See Appendix P 8.)

9. *Protection of river bank at Fort Brown, Texas.*—This work was designed to arrest the progress of encroachment which threatens, not only to destroy the most valuable buildings at the post, but to break through into the lagoon, which would entirely change the channel of the river, and leave the greater portion of the post on the opposite side of the channel.

The amount expended to June 30, 1883, is $16,769.96. The results attained have not been commensurate with the expenditure; and for reasons (explained in report of the officer in charge, for which see Appendix P 9) it has been considered best not to attempt to control the Rio Grande at this point by artificial works, and that it would be more expedient to move from time to time such of the buildings as may be in actual danger.

No further appropriation for this work is recommended.

July 1, 1882, amount available	$230 04
Amount appropriated by act passed August 2, 1882	1,000 00
July 1, 1883, amount available	1,230 04

(See Appendix P 9.)

IMPROVEMENT OF PEARL RIVER, MISSISSIPPI, AND OF VARIOUS WATER-COURSES IN LOUISIANA.

Officer in charge, Maj. Amos Stickney, Corps of Engineers.

1. *Pearl River, Mississippi, from Jackson to Carthage.*—The natural channel is much obstructed by logs, snags, drift, standing trees in the water, and overhanging trees on the banks.

The present project was adopted in 1880, the object being to obtain a channel of navigable width and 5-feet depth at low water.

The amount expended on the work up to the close of the fiscal year ending June 30, 1883, is $699.24, and was for inspection of contract work, office expenses, &c.

On the 30th of June, 1883, the river had been worked on under two contracts, but inspection showed it to be in worse condition than before. The contracts were therefore annuled.

The amount expended during the past fiscal year is $97.58. The amount that can be profitably expended during year ending June 30, 1885, is $2,500, to be applied, with balance of former appropriations, to removal of obstructions according to project.

July 1, 1882, amount available		$15,398 34
Amount appropriated by act passed August 2, 1882		2,500 00
		17,898 34
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		97 58
July 1, 1883, amount available		17,800 76
Amount (estimated) required for completion of existing project		2,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		2,500 00

(See Appendix Q 1.)

2. *Pearl River, below Jackson, Mississippi.*—The natural channel was much obstructed by snags, sunken logs, rafts, standing trees in the water, and overhanging trees on the banks, and a number of shoal places in the lower portion, near the mouth.

The present project for this work was adopted in 1880, the object being to obtain a navigable channel 5 feet deep at low-water from Jackson down to the mouth of the river.

The amount expended up to the close of the fiscal year ending June 30, 1883, is $60,543.49.

On the 30th of June, 1883, the river had been cleared for 295 miles from Jackson down, and work was in progress for closure of run-out bayous by hired labor.

The amount expended during the past fiscal year is $58,468.41, and was applied to the removal of obstructions under contract, and for work by hired labor in closing run-out bayous to scour out the shoal places.

July 1, 1882, amount available			$52,924 92
Amount appropriated by act passed August 2, 1882			15,000 00
			67,824 92
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$57,239 99		
July 1, 1883, outstanding liabilities	1,228 42		
			58,468 41
July 1, 1883, amount available			9,456 51
Amount (estimated) required for completion of existing project			25,940 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.			26,000 00

(See Appendix Q 2.)

3. *Amite River, Louisiana.*—The natural channel was much obstructed by snags, sunken logs, rafts, standing trees, and overhanging trees on the banks.

The original project was adopted in 1880, the object being to obtain a

channel of navigable width and 5 feet depth at low water, or as near that as possible, from the junction with Bayou Manchac continuously up-stream as far as the appropriation would permit without dredging.

The present project is a modification of original project, its object being to extend the work to the mouth of the Amite River in Lake Maurepas.

The amount expended on this work up to the close of the fiscal year ending June 30, 1883, is $8,466.90.

On the 30th of June, 1883, the river had been cleared for 40 miles above the junction of Bayou Manchac.

The amount expended during the past fiscal year is $8,164.64. No appropriation is asked for fiscal year ending June 30, 1885.

July 1, 1882, amount available	$12,697 74
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	8,164 64
July 1, 1883, amount available	4,533 10
Amount (estimated) required for completion of existing project	10,760 00

(See Appendix Q 3.)

4. *Vermillion River, Louisiana.*—The natural channel was much obstructed by snags, sunken rocks, and overhanging trees, and the mouth in Vermillion Bay by a mud bar.

The original project was adopted in 1880 and modified in 1881, the object being to obtain a channel of navigable width and depth from the railroad bridge above Vermillionville to Vermillion Bay.

The amount expended on this work up to the close of the fiscal year ending June 30, 1 83, is $10,153.32.

On the 30th of June, 1883, the river had been cleared for a distance of 47½ miles from the railroad bridge down-stream to its mouth, and a brush dike constructed to partially close the eastern entrance to the cove through which Vermillion River runs to reach the bay, completing the project.

The amount expended during the past fiscal year is $4,981. No appropriation is asked for fiscal year ending June 30, 1885.

July 1, 1882, amount available	$4,727 68
Allotment from examinations and surveys	253 32
	4,981 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4,981 00

(See Appendix Q 4.)

5. *Tangipahoa River, Louisiana.*—The natural channel was much obstructed by snags, sunken logs, rafts, standing trees in the water, and overhanging trees on the banks.

The original project for this work was adopted in 1880, the object being to obtain a channel of navigable width and 5 feet depth at low water, or as near that as possible without dredging.

The amount expended on this work up to the close of the fiscal year ending June 30, 1883, is $5,016.25.

On the 30th of June, 1882, the river had been cleared for 34 miles from its mouth, and at that date work was in progress on the next 7¼ miles, it having been delayed on account of high water.

The amount that can be profitably expended during the year ending June 30, 1885, is $3,700, to be applied to completion of work according to original project.

July 1, 1882, amount available	$1,991 01
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	7 26
July 1, 1883, amount available	1,983 75
Amount (estimated) required for completion of existing project	3,700 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	3,700 00

(See Appendix Q 5.)

6. *Tchefuncte River, Louisiana.*—The bar at the mouth of the river has but 4½ feet of water during north winds, and from Old Landing to Covington the river was obstructed with snags and overhanging trees.

The existing project for this work was adopted in 1880, the object being to dredge the bar at its mouth and removal of snags and overhanging trees up to Covington.

An examination before continuing the work upon the original plan, which included dredging at the mouth. is now in progress.

The amount expended up to the close of the fiscal year ending June 30, 1883, is $545.76.

On the 30th of June, 1883, the river had been cleared from Old Landing to Covington of snags, logs, and overhanging trees.

The amount that can be profitably expended during year ending June 30, 1885, is $2,500, to be applied to completing the work.

July 1, 1882, amount available	$1,042 24
Amount appropriated by act passed August 2, 1882	1,500 00
	2,542 24
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	88 00
July 1, 1883, amount available	2,454 24
Amount (estimated) required for completion of existing project	2,460 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	2,500 00

(See Appendix Q 6)

7. *Tickfaw River, Louisiana.*—The natural channel was much obstructed by snags and overhanging trees.

The original project for this work was adopted in 1881, the object being to obtain a channel of navigable width and depth for a distance of 26 miles up-stream.

The amount expended on this work up to the close of the fiscal year ending June 30, 1883, is $1, 919.90, at which time the river had been cleared for a distance of 18½ miles from the mouth.

The amount expended during the past fiscal year is $1,919.90.

The amount that can be profitably expended during the year ending June 30, 1885, is $6,300, to be applied, with balance of former appropriation, to completion of original project.

July 1, 1882, amount available	$1,915 26
Amount appropriated by act passed August 2, 1882	2,000 00
	3,915 26
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	1,919 90
July 1, 1883, amount available	1,995 36
Amount (estimated) required for completion of existing project	6,230 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	6,300 00

(See Appendix Q 7.)

8. *Bayou Teche, Louisiana.*—The natural channel is much obstructed with snags and overhanging trees.

The original project for this work was adopted in 1880, its object being to secure low-water navigation from Saint Martinsville to Leonville.

The amount expended on this work up to the close of the fiscal year ending June 30, 1883, is $10,348.62, at which time the river had been cleared of obstructions from Saint Martinsville to Leonville.

The amount expended during the past fiscal year is $3,813.27, resulting in a detailed survey of the bayou from the Teche end of the Charenton Canal to Port Barre.

The amount that can be profitably expended during the year ending June 30, 1885, is $50,000, to be applied to construction of a lock and dam, and for dredging and clearing the bayou below Saint Martinsville.

July 1, 1882, amount available		$19,464 65
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,724 60	
July 1, 1883, outstanding liabilities	88 67	
		3,813 27
July 1, 1883, amount available		15,651 38
Amount (estimated) required for completion of proposed project		130,000 00
Amount that can be profitable expended in fiscal year ending June 30, 1885		50,000 00

(See Appendix Q 8.)

9. *Connecting Bayou Teche with Grand Lake at Charenton Louisiana.*—The original project was adopted in 1880, the object being to connect Bayou Teche with Grand Lake at Charenton by the construction of a canal about 1 mile in length, 50 feet wide, and 5 feet deep.

The amount expended on this work up to the close of the fiscal year ending June 30, 1883, is $2,095.70.

A survey for locating the canal was completed in October, 1882, and a project for construction, based on this survey, was received at this office at the close of the fiscal year.

The amount expended during the past fiscal year is $1,321.70.

The amount that can be profitably expended during the year ending June 30, 1885, is $50,000, to be applied to construction of the canal.

July 1, 1882, amount available		$24,226 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$1,296 70	
July 1, 1883, outstanding liabilities	25 00	
		1,321 70
July 1, 1883, amount available		22,904 30
Amount (estimated) required for completion of existing project		50,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		50,000 00

(See Appendix Q 9.)

10. *Bayou Black, Louisiana.*—The natural channel is very narrow and much obstructed by logs, snags, and overhanging trees.

The original project was adopted in 1882, the object being to dredge a low-water channel 50 feet wide and 6 feet deep, commencing at Tigerville and going as far towards Houma as possible, and to clear the banks of overhanging trees.

The amount expended on this work up to the close of the fiscal year ending June 30, 1883, is $8,611.49, and was for *pro rata* payment for construction of a dredge-boat for service upon this and contiguous streams, and for dredging.

On the 30th of June the bayou had been improved a distance of 5,665 feet, with a channel 50 feet in width and 6 feet deep, and a number of logs and stumps and two wrecks removed from the bayou. Work was in progress at the close of the year.

The amount expended during the past fiscal year is $3,652.33.

The amount that can be profitably expended during year ending June 30, 1885, is to be applied, with amount now available, to continuation of work as far towards Houma as possible.

July 1, 1882, amount available		$5,040 84
Amount appropriated by act passed August 2, 1882		10,000 00
		15,040 84
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$2,858 12	
July 1, 1883, outstanding liabilities	794 21	
		3,652 33
July 1, 1883, amount available		11,388 51
Amount (estimated) required for completion of existing project		27,520 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		15,000 00

(See Appendix Q 10.)

11. *Bayou Courtableau, Louisiana.*—The Courtableau at low water is much obstructed near its mouth by a sand bar that frequently cuts off all communication with the Atchafalaya, and many snags and overhanging trees from Port Barre down to the Atchafalaya.

The original project was adopted in 1881, the object being to insure low-water navigation between the Courtableau and Atchafalaya by the removal of Little Devil Bar, and up the Courtableau to Washington by a dam and lock at the proper point.

The amount expended on this work up to the close of the fiscal year ending June 30, 1883, is $12,106.44.

On the 30th of June, 1883, Bayou Big Fordoche had been entirely closed, and Bayou Little Fordoche nearly so.

These bayous carried off a great deal of the water. High water necessitated suspension of work.

The amount expended during the past fiscal year is $3,191.59, resulting in closure of Little Fordoche Bayou, and cutting down of Little Devil Bar of 3 feet.

The amount that can be profitably expended during the year ending June 30, 1885, is to be applied to continuation of work of closure of the larger run-out bayous, so as to entirely remove Little Devil Bar.

The amount required for entire completion of work according to original project, including the construction of a lock, is, owing to increase of prices of labor and material, estimated at $63,500.

July 1, 1882, amount available		$6,085 15
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		3,191 59
July 1, 1883, amount available		2,893 56
Amount (estimated) required for completion of existing project		63,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		8,000 00

(See Appendix Q 11)

12. *Bayou Terrebonne, Louisiana.*—The natural low-water channel was very narrow and much obstructed by shoals and sunken logs.

The original project was adopted in 1880, the object being to obtain a channel of navigable width and 4 feet deep at low water from Houma down.

The amount expended on this work up to the close of the fiscal year ending June 30, 1883, is $25,706.58, at which date the bayou had been improved to within 10⅔ miles of Houma, and a channel 40 feet wide and 6 feet deep secured. Work was suspended in April, 1883, on account of exhaustion of appropriation.

The amount expended during the past fiscal year is $8,483.77.

July 1, 1882, amount available		$1,577 19
Amount appropriated by act passed August 2, 1882		7,000 00
		8,577 19
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$8,463 77	
July 1, 1883, outstanding liabilities	20 00	
		8,483 77
July 1, 1883, amount available		93 42
Amount (estimated) required for completion of existing project		13,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		13,000 00

(See Appendix Q 12.)

13. *Bayou Lafourche, Louisiana.*—The natural channel was much obstructed by snags, sunken logs, flat-boat wrecks, and overhanging trees on the banks.

The original project for this work was adopted in 1879, the object being to improve low-water navigation of the bayou by removal of all of the obstructions.

The amount expended on this work up to the close of the fiscal year ending June 30, 1883, is $24,324.99, at which time the bayou had been cleared to a point 30 miles below Lockport. With the amount expended during the past fiscal year the bayou was cleared for a length of 13 miles.

The amount that can be profitably expended during year ending June 30, 1885, is to be applied to continuation of removal of obstructions to the mouth of the bayou.

July 1, 1882, amount available		$4,663 92
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,926 90	
July 1, 1883, outstanding liabilities	62 00	
		3,988 91
July 1, 1883, amount available		675 01
Amount (estimated) required for completion of existing project		15,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		5,000 00

(See Appendix Q 13.)

14. *Calcasieu River, Louisiana.*—The natural channel is much obstructed by snags, sunken logs, and overhanging trees.

The original project for this work was adopted in 1881, the object being to obtain a channel of navigable width and depth from Phillips' Bluff to the mouth of the river in Lake Charles.

The amount expended during the past fiscal year was for an examination of the lower part of the river from Lake Charles to Calcasieu Lake, the object being to frame a project for the improvement of the river from Calcasieu Lake to Phillips' Bluff.

The amount available and the amount asked for fiscal year ending June 30, 1885, are to be applied to carrying out this project.

July 1, 1882, amount available		$2,991 39
Amount appropriated by act passed August 2, 1882		7,000 00
		9,991 39
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		194 55
July 1, 1883, amount available		9,796 84
Amount (estimated) required for completion of existing project		36,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		36,000 00

(See Appendix Q 14.)

15. *Calcasieu Pass, Louisiana.*—The cut, which had been dredged in 1873 and 1874, had filled up considerably, and only 4 feet of water was to be found across the flat at the foot of Calcasieu Lake.

The original project for this work was adopted in 1872 and modified in 1881, the object being to obtain a channel of navigable width and depth across the flat at the foot of Calcasieu Lake.

The amount expended on this work up to the close of the fiscal year ending June 30, 1883, is $12,000.

On the 30th of June, 1883, a cut through the bar at the lower end of Calcasieu Lake 7,500 feet long, 70 feet wide at bottom, and 8 feet deep had been obtained.

No appropriation is asked for next fiscal year, as it is not known whether the dredged channel has filled up again.

July 1, 1882, amount available		$156 75
Amount appropriated by act passed August 2, 1882		3,000 00
		3,156 75
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		156 75
July 1, 1883, amount available		3,000 00

(See Appendix Q 15.)

16. *Removal of wreck in Pass Marianne, Mississippi Sound.*—The removal of this wreck was completed July 2, 1882.

Allotment from amount appropriated by act passed June 14, 1880		$4,031 12
July 1, 1882, amount expended	$90 62	
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,940 50	
		4,031 12

(See Appendix Q 16.)

EXAMINATIONS AND SURVEYS FOR IMPROVEMENT.

To comply with requirements of the river and harbor act of June 14, 1880, Major Stickney was charged with and has reported to this office the results of the following, which had been delayed in consequence of the death of the officer originally charged with this duty:

1. *West Pearl River, Louisiana.* (See Appendix Q 17.)
2. *Grand Lake, Louisiana.* (See Appendix Q 18.)
3. *Bogue Chitto River, Louisiana.* (See Appendix Q 19.)

WESTERN RIVERS.

IMPROVEMENT OF RED RIVER, AND RIVERS IN LOUISIANA AND ARKANSAS—IMPROVEMENT OF CERTAIN RIVERS IN MISSISSIPPI AND TENNESSEE, TRIBUTARY TO THE MISSISSIPPI—WATER-GAUGES ON THE MISSISSIPPI AND ITS PRINCIPAL TRIBUTARIES.

Officer in charge, Maj. A. M. Miller, Corps of Engineers.

1. *Red River, Louisiana.*—The improvement of this stream was commenced in 1872, and appropriations were made for carrying on the work under the following heads: Removing raft in Red River and closing Tone's Bayou, Louisiana, removing obstructions from Red River, Louisiana, and improving Upper Red River, from Fulton, Ark., to head of raft. These items of improvement were combined under the title "improving Red River, Louisiana," in the river and harbor act of August 2, 1882, and it includes the whole river from the mouth of the Atchafalaya to Fulton, Ark.

The improvement of the river has consisted in the removal of snags and other obstructions, in the removal of the raft, and the deepening of the water over the shoal places. The navigation has been greatly improved thereby, and boats now navigate the river from its mouth to Fulton, Ark., during the whole year.

During the fiscal year the United States snag-boats C. W. Howell and John R. Meigs, and the United States steamer Thos. B. Florence were employed in removing obstructions above and below Shreveport.

A contract was awarded for removing rock from the bed of the falls at Alexandria, La., but owing to the high water no work has yet been done.

During the coming fiscal year it is proposed to complete the work at Alexandria and to remove obstructions with the snag-boats as long as the funds available will permit, and it being considered indispensable that a complete survey with lines of levels be made from Tone's Bayou through Bayou Pierre and Red River to the point where the waters of Bayou Pierre again join Red River before the question of removing the raft in Bayou Pierre is decided; it is recommended that the sum of $8,600 be appropriated for this purpose in addition to the sum of $75,000 required for continuing the improvement of Red River.

A preliminary examination of Bayou Pierre was made in February and March last, the result of which will be found in Appendix R 2 of this report.

Amounts expended to June 30, 1882:	
For removing raft and closing Tone's Bayou	$395,079 29
For removing obstructions from Red River	116,053 24
For improving Upper Red River	17,125 81
Total	528,258 34
Amounts expended durjng the fiscal year ending June 30, 1883:	
For removing raft and closing Tone's Bayou	7,854 69
For removing obstructions from Red River	1,446 76
For improving Upper Red River	2,874 19
For improving Red River, Louisiana	36,466 59
Total	48,642 23
Amount asked for fiscal year ending June 30, 1885	75,000 00

July 1, 1882, amounts available:		
From appropriation for removing raft in Red River and closing Tone's Bayou, La		$24,420 17
From appropriation for removing obstructions from Red River, Louisiana		1,446 76
From appropriation for improving Upper Red River from Fulton, Ark., to head of raft		2,874 19
		28,741 66
Amount appropriated by act passed August 2, 1882		75,000 00
		103,741 66
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$48,642 23	
July 1, 1883, outstanding liabilities	40,000 00	
		88,642 23
July 1, 1883, amount available		15,099 43
Amount that can be profitably expended in fiscal year ending June 30, 1885.. and $8,600 in addition for proposed survey through Bayou Pierre.		75,000 00

(See Appendixes R 1, R 2, R 3, and R 4.)

2. *Yazoo River, Mississippi.*—The work upon the Yazoo River, which was commenced in 1874, consists in the removal of snags, logs, and other obstructions to the safe navigation of the stream.

Up to the 30th of June, 1882, thirteen wrecks had been removed, and the navigation otherwise improved by the removal of a large number of snags, logs, &c. The snag-boat John R. Meigs was employed in the river during the past season.

Amount expended to June 30, 1882	$124,693 69

The sum asked for will be applied to the removal of obstructions from the river, as heretofore.

July 1, 1882, amount available		$306 31
Amount appropriated by act passed August 2, 1882		8,000 00
		8,306 31
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		8,005 13
July 1, 1883, amount available		301 18
Amount that can be profitably expended in fiscal year ending June 30, 1885.		24,000 00

(See Appendix R 5.)

3. *Big Sunflower River, Mississippi.*—This work was commenced in 1879, and has been continued up to the present time. The navigation of the stream has been greatly improved by the removal of snags, logs, &c., and by the deepening of the water over the shoal places by means of wing-dams.

During the past season the work was done between Standing Stump and Clarksdale, and consisted in the cutting of leaning timber and the removal of smaller snags.

Amount expended to June 30, 1882	$30,645 38

With the amount asked for fiscal year ending June 30, 1885, it is intended to equip a boat with steam-power, and continue removing snags and other obstructions from the stream.

July 1, 1882, amount available	$1,354 62
Amount appropriated by act passed August 2, 1882	5,000 00
	6,354 62
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4,340 54
July 1, 1883, amount available	2,014 08
Amount (estimated) required for completion of existing project	29,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	15,000 00

(See Appendix R 6.)

4. *Tallahatchie River, Mississippi.*—Work was commenced upon this improvement in September, 1879, and consisted in the removal of obstructions to the navigation of the stream. In accordance with requirements in last river and harbor act, all of the appropriation was expended above mouth of Coldwater this season.

That the navigation of this stream has been greatly improved is shown by the fact that a boat has been built for the navigation of the river between Batesville and mouth of Coldwater. This is the first boat that has navigated the upper river since the war.

The original estimated cost of this improvement was $40,000. With the amount asked for fiscal year ending June 30, 1885, it is proposed to continue the improvement as heretofore.

Amount appropriated by act passed August 2, 1882	$3,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	2,681 72
July 1, 1883, amount available	318 28
Amount (estimated) required for completion of existing project	19,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	10,000 00

(See Appendix R 7.)

5. *Coldwater River, Mississippi.*—This improvement was commenced in 1879, and consisted in the removal of obstructions to navigation.

No work has been done for the last two seasons, no appropriations having been asked, as the officer in charge states that to put the stream in a navigable condition would require the expenditure of a larger amount of money than the commerce of the country will warrant.

Amount expended to June 30, 1882	$9,660 99

No appropriation is asked for the fiscal year ending June 30, 1885.

July 1, 1882, amount available	$1,339 01
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	345 10
July 1, 1883, amount available	993.91

(See Appendix R 8.)

6. *Tchula Lake, Mississippi.*—Work upon this stream was commenced in 1881, and has been continued up to the present time.

The navigation of the lake has been greatly improved by the removal of overhanging timber and snags. Boats now enter the lake much earlier in the season than heretofore, and are also enabled to run much later.

Amount expended to June 30, 1882	$3,000
The original estimated cost of this improvement was	10,000

With the amount asked for the fiscal year ending June 30, 1885, it is proposed to continue the improvement as heretofore.

Amount appropriated by act passed August 2, 1882	$2,500 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	2,228 54
July 1, 1883, amount available	271 46
Amount (estimated) required for completion of existing project	4,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	4,500 00

(See Appendix R 9.)

7. *Yallabusha River, Mississippi.*—This improvement was begun in 1881, and has consisted in the removal of obstructions to navigation from the stream.

The navigation of the river has been greatly improved thereby, and where formerly but little, if any, commerce found its way to market by this river, now about one-quarter is shipped that way, and if the improvement is continued the greater portion will eventually find its way out by this means.

Amount expended to June 30, 1882	$3,500
The original estimated cost of this improvement was	7,000

With the amount asked for fiscal year ending June 30, 1885, it is proposed to continue the improvement as heretofore. Although the amount of the original estimate for the improvement of this stream, $7,000, has been appropriated and nearly all expended, owing to the nature of the stream continual changes are taking place, which require constant work in the way of snagging and removing fallen timber, and for this purpose $3,500 is asked, to be expended during the fiscal year.

Amount appropriated by act passed August 2, 1882	$3,500 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,400 24
July 1, 1883, amount available	99 76
Amount that can be profitably expended in fiscal year ending June 30, 1885	3,500 00

(See Appendix R 10.)

8. *Big Hatchie River, Tennessee.*—Work upon this improvement commenced in August, 1880, and has resulted in giving greatly increased facilities for navigation. The operations consisted in removing snags, logs, and other obstructions from the bed and banks of the river.

During the past season a party worked from Bolivar to Reed's Landing, about 27½ miles from the mouth.

Amount expended to June 30, 1882	$13,068 11
The original estimated cost of this improvement was	30,000 00

With the amount asked for fiscal year ending June 30, 1885, it is proposed to continue the improvement as heretofore.

July 1, 1882, amount available	$431 89
Amount appropriated by act passed August 2, 1882	3,000 00
	3,431 89
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,170 63
July 1, 1883, amount available	261 26
Amount (estimated) required for completion of existing project	13,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	10,000 00

(See Appendix R 11.)

9. *South Forked Deer River, Tennessee.*—With the appropriation of August 2, 1882, the first made for this river, it is proposed to remove

obstructions from the bed and banks of the stream. For this purpose a party will be sent to the river with the necessary outfit as soon as the stage of water will permit. With the appropriation asked for the fiscal year ending June 30, 1885, work will be carried on as above.

The total length of the stream needing improvement is 100 miles, and the cost of removing its obstructions was estimated in 1880 at $19,250.

Amount appropriated by act passed August 2, 1882	$3,000 00
July 1, 1883, amount available	3,000 00
Amount (estimated) required for completion of existing project	16,250 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	10,000 00

(See Appendix R 12.)

10. *Ouachita River, Arkansas and Louisiana.*—The improvement of this stream was commenced in 1871. The navigation has been greatly improved by the removal of snags, wrecks, &c., and by the deepening of the water over the shoal places by means of wing-dams.

The first project adopted for the improvement was by means of locks and dams, but this was abandoned, and operations were confined to the removal of obstructions and the improvement of the shoals. During the past season the operations were carried on as heretofore with the snag-boat O. G. Wagner, which worked in the stream from August 29 to November 30.

Amount expended on present project (including cost of iron-hull snag-boat and outfit) to June 30, 1882	$147,700 62

With the amount asked for fiscal year ending June 30, 1885, it is proposed to continue the snagging operations with the Wagner, remove certain wrecks now obstructing navigation, complete the dams at Catahoula Shoals, and build wing-dams on the other shoal places.

July 1, 1882, amount available	$1,711 51
Amount appropriated by act passed August 2, 1882	12,000 00
	13,711 51
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	13,711 51
Amount that can be profitably expended in fiscal year ending June 30, 1885.	20,000 00

(See Appendix R 13.)

11. *Bayou Bartholomew, Louisiana and Arkansas.*—This improvement was commenced in July, 1881, and consists in the removal of obstructions from bed and banks of the stream.

Work was resumed this season at the point where it had been left off the previous one. The navigation of the bayou has been greatly improved, and boats now run regularly during high water to Baxter, Ark., the present head of navigation.

Amount expended to June 30, 1882	$7,417 74
The original estimated cost of this improvement was	26,862 00

With the amount asked for fiscal year ending June 30, 1885, it is proposed to continue the improvement as heretofore.

July 1, 1882, amount available	$582 26
Amount appropriated by act passed August 2, 1882	5,000 00
	5,582 26
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,976 81
July 1, 1883, amount available	1,605 45

Amount (estimated) required for completion of existing project	$13,862 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	14,000 00

(See Appendix R 14.)

12. *Tensas River, Louisiana.*—Work upon this improvement was commenced in September, 1881, and consisted in the removal of obstructions to navigation.

No work was done during the last season, no money having been available.

Amount expended to June 30, 1882	$3,000
The original estimated cost of this improvement was	23,000

With the amount asked for fiscal year ending June 30, 1885, it is proposed to continue the improvement as heretofore.

Amount (estimated) required for completion of existing project	$20,000
Amount that can be profitably expended in fiscal year ending June 30, 1885.	10,000

(See Appendix R 15.)

13. *Bœuf River, Louisiana.*—This improvement was begun in August, 1881, and consisted in cutting down the leaning trees along the banks and removing obstructions from the river.

The navigation has been greatly improved thereby, and boats now run regularly, during the high-water season, to Jefferson, La.

Amount expended to June 30, 1882	$5,000
The original estimated cost of this improvement was	20,000

With the amount asked for fiscal year ending June 30, 1885, it is proposed to continue the improvement as heretofore.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4,743 99
July 1, 1883, amount available	256 01
Amount (estimated) required for completion of existing project	10,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	10,000 00

(See Appendix R 16.)

14. *Cypress Bayou, Texas and Louisiana.*—The first project for the improvement of Cypress Bayou, which consisted in cutting and dredging a channel through the lakes and bayou, has been completed, and a good high-water channel has thus been obtained from Red River, Louisiana, to Jefferson, Tex.

The second project for the improvement of this bayou consists in constructing a dam across the lakes at Albany Point, and making a cut through to Red River. The estimated cost of this project was $372,580, and should it be desirable to adopt it, the whole amount should be appropriated at once for the successful execution of the work. The result of this work will be to give good navigation to Jefferson, Tex., nearly all the year round, and also to improve the navigation of Red River in the vicinity of Shreveport.

Amount expended to June 30, 1882	$91,415 42
July 1, 1882, amount available	2,584 58
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	845 78
July 1, 1883, amount available	1,738 80

(See Appendix R 17.)

15. *Water-gauges on the Mississippi River and its principal tributaries.*—Observations were continued at all the gauges, and repairs made and new gauges erected where necessary.

An inspection of all the gauges was also begun, but after six of the gauges had been inspected it was discontinued for want of necessary funds.

New high-water marks were established at Cairo, Ill., and Louisville, Ky., as the flood of this year exceeded all previous records.

July 1, 1882, amount available	$759 29
Amount appropriated by act passed August 2, 1882	5,000 00
	5,759 29
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,897 35
July 1, 1883, amount available	1,861 94
Amount that can be profitably expended in fiscal year ending June 30, 1885.	5,000 00

(See Appendix R 18.)

REMOVING SNAGS, ETC., FROM THE ARKANSAS RIVER—IMPROVEMENT OF ARKANSAS RIVER, BETWEEN FORT SMITH AND WICHITA AND AT PINE BLUFF, AND OF RIVERS SAINT FRANCIS, WHITE L'ANGUILLE, FOURCHE LA FÉVE, SALINE, BLACK, AND CURRENT, IN ARKANSAS AND MISSOURI.

Officer in charge, Capt. Thomas H. Handbury, Corps of Engineers.

1. *Removing snags, &c., from Arkansas River, Arkansas.*—The work done under this appropriation consists in removing snags and like obstructions to navigation. Two snag boats were employed, the C. B. Reese and the Wichita. Their operations were confined to a reach of the river extending from the mouth to Fort Smith, Ark., a distance of about 475 miles.

The *Reese* was at work here from the middle of July until the end of August, and again from the first of November to the end of January, working four and one-halt months in all.

The *Wichita* commenced operations in this reach of the river October 1, and continued until the end of December.

The two boats during the season removed one thousand two hundred and eighty-seven snags and twelve drift piles.

This work has been very beneficial, and has given satisfaction to those interested in the commerce of the river. It is proposed to continue these operations during the coming season as far as funds available will permit.

The removal of obstructions of this character affords but temporary relief, and must be continued from year to year, and as the country becomes settled the necessity for devising some plan of permanent improvement becomes apparent. With a view to this the officer in charge submits in his report an estimate of $21,000 for continuing the survey of the Arkansas River, made in 1869, from Fort Gibson, Indian Territory, to Little Rock, down to its mouth, in addition to an estimate of $36,000 for carrying on the usual snagging operations.

July 1, 1882, amount available	$4,356 41
Amount appropriated by act passed August 2, 1882	35,000 00
	39,356 41
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	21,213 28
July 1, 1883, amount available	18,143 13
Amount that can be profitably expended in fiscal year ending June 30, 1885.	57,000 00

(See Appendix S 1.)

2. *White and Saint Francis rivers, Arkansas.*—The object of this work is the removal of snags, overhanging trees, wrecks, and other obstructions to the navigation of these streams.

The operations upon the White River were carried on from the snag-boat C. B. Reese, which was detailed for a short season of two months, September and October, for work upon this stream between its mouth and Jacksonport, Ark.

Work upon the Saint Francis River was carried on in the same manner as last season. An outfit was chartered and the necessary labor hired. The reach of this river worked over extended from Wittsburgh down through the "cut-off" to the mouth of "Old River," a distance of 65 miles. These two rivers being entirely dissimilar in character, a plant that would be suitable for economical work in one is not adapted to the other. The officer in charge therefore suggests that a separate appropriation be made for each. With the snag-boat now provided the necessary snagging work upon the White River as high up as Jacksonport, Ark., could be economically done. This outfit is too large for work upok the Saint Francis.

ESTIMATE FOR THE FISCAL YEAR ENDING JUNE 30, 1885.

White River, below Jacksonport, Ark., working expenses of snag-boat, including incidental repairs, six months, at $3,000 per month		$18,000 00
Expenses in ordinary and general repairs		2,000 00
		20,000 00
Saint Francis River, Arkansas, outfit	$4,000 00	
Working expenses of same eight months, at $1,500 per month	12,000 08	
		16,000 00
		36,000 00
Total amount of appropriation to date		154,000 00
July 1, 1882, amount available		505 64
Amount appropriated by act passed August 2, 1882		12,000 00
		12,505 64
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		9,363 68
July 1, 1883, amount available		3,141 96
Amount that can be profitably expended in fiscal year ending June 30, 1885.		36,000 00

(See Appendix S 2.)

3. *Arkansas River at Pine Bluff, Arkansas.*—The object of this improvement is to prevent a cut-off which threatens to take place at a point a few miles above Pine Bluff and leave this city several miles from a steamboat landing, and also to so rectify the channel of the river as to generally improve the navigation in this vicinity.

To accomplish this object it is necessary to grade and revet the eroding banks of the narrow neck of land where the danger exists. Work has been carried on here for three seasons, with only partial success. On account of the limited appropriations for each season, it was necessary at the end to leave the work in an exposed condition, which resulted in more or less damage being done by the high water to the bank protection. The work of the present season was practically devoted to the repairs necessary to be done to that of last. Three thousand feet of the bank was regraded, and 2,400 feet of this protected by a low-water protection extending 80 feet from the bank; 1,000 feet of high-

water protection was put in place. This connects with the low-water protection and extends 80 feet up the graded bank.

The protection is essentially the same as that heretofore used upon this work. In consequence of the want of the necessary funds for proceeding further with the bank protection, the work is necessarily again left in an exposed condition.

July 1, 1882, amount available	$1,809 01
Amount appropriated by act passed August 2, 1882	20,000 00
	21,809 01
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	19,755 18
July 1, 1883, amount available	2,053 83
Amount (estimated) required for completion of existing project	32,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	32,000 00

(See Appendix S 3.)

4. *Arkansas River between Fort Smith, Arkansas, and Wichita, Kansas.*—The object of this improvement is to remove snags, rocks, overhanging trees, and other obstructions to navigation between the points named, and thus provide a means of water transportation for the surplus products of a large portion of Western Kansas and the Indian Territory.

The work of last season was confined to the operations of the snagboat Wichita, during the months of July, August, and September, upon that reach of the river between Fort Smith, Ark., and Fort Gibson, Indian Territory.

The commerce of this portion of the river was greatly benefited by the work done.

It is proposed during the coming season to continue the snagging operations, and also to remove some gravel shoals and ledges of rock that are troublesome to navigation during the low-water season.

Total amount of appropriations to date	$79,000 00
July 1, 1882, amount available	8,622 84
Amount appropriated by act passed August 2, 1882	20,000 00
	28,622 84
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	7,051 83
July 1, 1883, amount available	21,571 01
Amount that can be profitably expended in fiscal year ending June 30, 1885	30,000 00

(See Appendix S 4.)

5. *White River between Jacksonport and Buffalo Shoals, Arkansas.*—The object of this improvement is the removal of snags, wrecks, &c., from the channel of the river, overhanging trees from the banks, and the concentration of the water to increase its depth over shoals.

A small party was at work upon this reach of the river from the middle of August to the middle of November. During this time one hundred and two snags and fifteen hundred and forty-one overhanging trees were removed. A brush and gravel dam 294 feet long was put in the bed of the river near Bell's Point for the purpose of improving a very bad shoal that had formed at that point. The work resulted in great relief to navigation.

The officer in charge suggests the propriety of taking other steps

looking to the permanent improvement of the White River throughout its entire navigable length. With this object in view he submits an estimate for an accurate instrumental survey from its mouth to Forsyth, Mo., a distance of about 600 miles, amounting to $50,000, half of which could be profitably expended in one season.

ESTIMATE FOR THE FISCAL YEAR ENDING JUNE 30, 1885.

Continuing work according to the present plan of improvement, improving shoals, removing snags, &c	$20,000 00
Survey of White River from Forsyth, Mo., to its mouth (which is not included in the estimates from this office)	25,000 00
July 1, 1882, amount available	2,265 68
Amount appropriated by act passed August 2, 1882	6,000 00
	8,265 68
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	2,146 80
July 1, 1883, amount available	6,118 88
Amount that can be profitably expended in fiscal year ending June 30, 1885	20,000 00

(See Appendix S 5.)

6. *White River above Buffalo Shoals, Arkansas.*—The present project for this improvement contemplates removing loose rocks, blasting others, constructing wing-dams at various shoals, removing snags, and cutting overhanging trees, so as to make the river in this region navigable at medium and high stages.

On account of the late date at which the appropriations of last year became available, and the unfavorable stage of the water during the remainder of the year, it was thought best not to renew operations upon this work.

With the funds now available it is proposed to remove some obstructions yet remaining at Buffalo Shoals, so as to give the same depths of water there as above, to repair the wing-dams, which have been more or less damaged by high water since their construction, and to continue the work of improvement up the river, in accordance with the project approved, as far as the funds will suffice.

July 1, 1882, amount available	$1,652 84
Amount appropriated by act passed August 2, 1882	4,000 00
	5,652 84
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	120 00
July 1, 1883, amount available	5,532 84
Amount (estimated) required for completion of existing project	32,600 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	12,000 00

(See Appendix S 6.)

7. *L'Anguille River, Arkansas.*—No work was done upon this stream during the year.

It is proposed to expend the funds yet available for this improvement in removing snags, overhanging trees, and other obstructions to navigation as occasion may require.

Total amount of appropriations to date	$17,000 00
July 1, 1882, amount available	3,149 47
July 1, 1883, amount available	3,149 47

(See Appendix S 7.)

8. *Fourche Le Féve River, Arkansas.*—The object of this improvement is to remove snags, overhanging trees, and other obstructions to the navigation of the river. The work of the season was done between its mouth and Harrison Shoals, a distance of 60 miles. This reach of the river was worked over last season.

The work was done between September 1 and December 10, with a chartered steamer of small draught and hired labor.

The navigable portion of this stream lies between its mouth and Perryville, 40 miles above. Occasionally on extreme high water a boat goes to Harrison Shoals.

Any improvement above this point would only be for the benefit of flat-boat navigation, or to facilitate the rafting of logs and railroad ties. That portion of the river that has been improved is now reported in very good condition. Whenever there is sufficient water the small boats that ply in the stream have no difficulty in navigating it. The improvement has been of great benefit to the settlers in the valley.

Should it be deemed advisable to continue the improvement above Harrison's Shoal, $10,000 could be expended thereon during the coming fiscal year.

July 1, 1882, amount available	$101 85
Amount appropriated by act passed August 2, 1882	4,000 00
	4,101 85
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4,101 85

(See Appendix S 8.)

9. *Black River, Arkansas.*—At the beginning of the fiscal year there was a small balance of $810.66 of this appropriation available. This being too small an amount with which to commence any independent operations, it was thought best to hold it until the party working above the Arkansas line on this river, under the appropriation for Black River, Arkansas and Missouri, should work down within the limits, and then devote it to defraying the expenses of this party. The party has not reached the limit yet. The balance remains substantially as it was. The estimate for further work upon this part of the river is included in that submitted under the head of Black River, Arkansas and Missouri.

July 1, 1882, amount available	$810 66
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	17 50
July 1, 1883, amount available	793 16

(See Appendix S 9.)

10. *Black River, Arkansas and Missouri.*—The object of this work is to improve the navigation of the river by removing snags and logs from the channel, overhanging trees from the banks, and increasing the depth of water over troublesome shoals.

The work was commenced last season at Poplar Bluff, Missouri, and carried down 20 miles. The work of this season commenced in the latter part of September and was continued until the end of December. Eleven miles of the river were cleared of obstructions, making 31 miles that are now clear and in good navigable condition.

There are yet 115 miles of this river from which obstructions are to be removed before it can be said to be in a fair navigable condition.

It is proposed during the coming season to continue these operations as far as the funds available will permit.

The officer in charge suggests the advisability of procuring more suitable and economical appliances for prosecuting this work. He estimates that a suitable outfit can be procured for about $15,000, and that the running expense for the coming fiscal year would be about $15,000, more, making the total that could be profitably expended, $30,000.

July 1, 1882, amount available		$859 25
Amount appropriated by act passed August 2, 1882		10,000 00
		10,859 25
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		5,980 65
July 1, 1883, amount available		4,878 60
Amount that can be profitably expended in fiscal year ending June 30, 1885.		30,000 00

(See Appendix S 10.)

11. *Saline River, Arkansas.*—The object of this work is to clear the river of snags and overhanging trees. The operations are carried on by hired labor furnished with the necessary outfit. The work of the season commenced at Longview and extended down to Godfrey's Landing, a distance of about 50 miles.

The total distance that has been worked over on this stream, from Big Island, the place of beginning, to Godfrey's Landing, is 230 miles, leaving 20 miles yet remaining to its junction with the Ouachita.

July 1, 1882, amount available		$2,474 32
Amount appropriated by act passed August 2, 1882		4,000 00
		6,474 32
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		4,128 25
July 1, 1883, amount available		2,346 07
Amount (estimated) required for completion of existing project		17,651 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		10,000 00

(See Appendix S 11.)

12. *Current River, Missouri and Arkansas.*—With the small balance of $534.83 which remained available for this work at the end of the last fiscal year a boat and crew were hired for a few days during last September to work upon this stream. During the time they were so employed eighty-five snags were removed between the mouth and Shoemaker's Landing. Total amount of appropriations to date, $7,000. Congress having omitted this item from the river and harbor act of 1882, it is assumed that a further prosecution of this work is not at present desired. No estimate is therefore submitted.

(See Appendix S 12.)

IMPROVEMENT OF THE MISSISSIPPI RIVER BETWEEN THE MOUTHS OF THE ILLINOIS AND OHIO RIVERS—IMPROVING HARBOR AND MISSISSIPPI RIVER AT ALTON—MISSISSIPPI RIVER OPPOSITE THE CITY OF SAINT LOUIS, AND AT OR NEAR CAPE GIRARDEAU AND MINTON POINT—IMPROVEMENT OF OSAGE RIVER IN KANSAS AND MISSOURI.

Officer in charge, Maj. O. H. Ernst, Corps of Engineers, having under his immediate orders First Lieut. F. V. Abbot, Corps of Engineers.

1. *Mississippi River between the Illinois and Ohio rivers.*—Work was carried on at Arsenal Island, Horsetail, Twin Hollows (west bank), Twin Hollows (east bank), Pulltight, Beard's Island, "Jim Smith's," Chesley

Island, Foster's Island, Piasa Island, and Alton Harbor. All of these works except the last two constitute part of one connected whole, carried on under the general scheme of making the improvement continuous, beginning at Saint Louis and working down-stream, reducing the river to an approximately uniform width of about 2,500 feet, and protecting its banks from erosion.

Arsenal Island.—The project for the improvement of this locality was adopted in 1876, its object being to stop the erosion of the west side of Arsenal Island and the consequent deterioration of the navigation. The amount expended during the year was $6,535.92. The total amount expended to June 30, 1883, is $30,732.65, and has resulted in the protection of 7,843 feet of bank, a part of which, measuring 2,923 feet in length, is not quite completed, though nearly so. It is proposed to complete the unfinished portions.

Horsetail.—The present project for the improvement of this locality was adopted in 1873, and modified in 1879, the object being to afford a channel not less than 8 feet deep.

The natural channel was often not more than 4 feet in depth and was tortuous. The amount expended during the year was $51,473.93. The total amount expended to June 30, 1883, is $661,556.60, of which, however, but $355,863.26 has been employed upon the system adopted in 1879. It has resulted in securing a direct navigable channel, with a depth not less than 8½ feet.

Further work will be required to preserve these results, the amount of which is a matter of future contingency.

Twin Hollows, west bank.—The present project for the improvement of this locality was adopted in 1881, the object being to afford a channel not less than 8 feet deep. The natural channel was often not more than 4 feet deep in the shoalest parts. The amount expended during the year was $93,136.91. The total amount expended to June 30, 1883, is $196,637.16, and has resulted in securing a navigable channel in which the depth during the year has not been less than 8 feet, but which is still tortuous, though less so than last year. It is intended during the coming year to thoroughly repair the works already constructed, and to push them forward as rapidly as it shall be found practicable to straighten the channel without interfering with navigation.

Twin Hollows, east bank.—The present project for the improvement of this locality was adopted in 1881, the object being to stop the caving, which extended over a length of 8,400 feet of the bank, and the consequent deterioration of the navigation. Before the work was begun the caving was progressing at the rate of several feet per day. The amount expended during the year was $23,232.31. The total amount expended to June 30, 1883, is $95,928.94, and has resulted in the protection of 8,625 feet of bank, of which 2,800 feet is completed, and the remainder well advanced. It is proposed during the coming year to complete the unfinished portions.

Pulltight.—The present project for the improvement of this locality was adopted in 1881, the object being to afford a channel not less than 8 feet deep. The natural channel was often not more than 4 feet deep in the shoalest parts. The amount expended during the year, which includes all expenditures to June 30, 1883, was $46,465.47, and has resulted, in connection with the works at Twin Hollows, west bank, in securing a navigable channel in which the depth during the year was not less than 8 feet. Much further work will be required before this result can be considered permanent. It is proposed during the coming year to extend the works down-stream to connect with Beard's Island.

Beard's Island.—The present project for the improvement of this locality was adopted in 1881, the object being to close a small chute north of the island, and to stop the erosion of the west side of the island and the consequent deterioration of the navigation. Before the work was begun the caving was progressing at the rate of several feet per day and the water in the chute was 40 feet deep. The amount expended during the year was $55,810.47. The total amount expended to June 30, 1883, is $84,258.76, and has resulted in closing the chute and stopping the caving throughout the length of the island, a distance of 7,300 feet, of which 2,500 feet is completed and the remainder well advanced.

"*Jim Smith's.*"—The present project for the improvement of this locality was adopted in 1881, the object being to afford a channel not less than 8 feet deep. The natural channel was often not more than 4 feet deep in the shoalest parts.

The amount expended during the year was $103,418.37. The total amount expended to June 30, 1883, is $114,486.74, and has resulted in securing a navigable channel in which the depth during the year was not less than 8½ feet. External causes contributed to this depth, which is not regarded as permanent without much further work. It is proposed during the coming year to thoroughly repair the works already constructed, and to extend them down-stream as rapidly as the limited means available will permit.

Chesley Island.—The present project for the improvement of this locality was adopted in 1881, the object being to stop the erosion of the east side of the island, and the consequent deterioration of the navigation, and also to close the chute west of the island, in order to afford, in connection with the works at "Jim Smith's," a channel not less than 8 feet deep. The bank was caving at the rate of several feet per day, and the natural channel was often not more than 4 feet deep in the shoalest parts. The amount expended during the year, which includes all expenditures to June 30, 1883, was $47,401.39, and has resulted in the protection of the east side of the island for a length of 4,305 feet, and in partially closing the chute, affording, in connection with the works at "Jim Smith's" and external causes, a navigable channel in which the depth during the year was not less than 8½ feet. Much further work will be required to make this depth of channel permanent. It is proposed during the coming year to complete the closure of the chute and to build out the Missouri Bank below the island.

Foster's Island.—The present project for the improvement of this locality was adopted in 1881, its object being to stop the caving of the west side of the island and the consequent deterioration of the navigation. Before the work was begun the caving was progressing at the rate of several feet per day. The amount expended during the year, which includes all expenditures to June 30, 1883, was $5,779.18, and has resulted in the partial protection of 580 feet of the bank. It is proposed during the coming year to continue the protection to the foot of the island, a distance of about 4,000 feet.

Piasa Island.—There is not at this time any definite project for the improvement of this locality. A dam constructed in 1875–1877 having become a dangerous obstruction to navigation, immediate relief to the latter was given by removing a portion of the dam. The amount expended was $2,750.11.

Alton Harbor.—The present project for the improvement of this harbor was adopted in 1881, the object being to remove a shoal in front of the down-stream portion of the landing. The amount expended during the year was $34,000. The total amount expended to June 30, 1883, is

$67,324.70, and has resulted in removing a large part of the shoal. The works are still acting favorably upon the shoal, and it is not proposed to do anything more here until their final results shall be developed.

Estimate.—The officer in charge modifies and increases his total estimate for the final completion of the improvement.

The appropriation of $1,000,000 asked for is to be applied to completing the works now progressing and to beginning new works below Foster's Island. From the changeable nature of the stream it is not practicable to give in advance the names of the exact localities where work will be required. The programme is to make the improvement continuous, working down-stream from Saint Louis, by reclaiming land and building up new banks, thus reducing the width of the river to the uniform width of about 2,500 feet. Caving banks are to be protected. The appropriation of the above sum is recommended.

July 1, 1882, amount available		$112,145 18
Miscellaneous receipts		86 64
Amount appropriated by act passed August 2, 1882		600,000 00
		712,231 82
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$510,995 09	
July 1, 1883, outstanding liabilities	5,991 15	
		516,986 24
July 1, 1883, amount available		195,245 58
Amount (estimated) required for completion of existing project		14,152,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		1,000,000 00

(See Appendix T 1.)

2. *Harbor and Mississippi River at Alton.*—The present project for the improvement of this harbor was adopted in 1881, the object being to remove a shoal in front of the down-stream portion of the landing. The amount expended during the year was $34,000, allotted by Congress from the general appropriation for improving the Mississippi River from Cairo to the Illinois River. The total amount expended to June 30, 1883, is $67,324.70, and has resulted in removing a large part of the shoal. As the works are still acting favorably it is not proposed to do anything more here until their final results shall be developed.

The appropriation of $5,000 asked for is to be used for completing the dike as originally designed should that become necessary and filling up any depressions that may occur from settlings. Such work, if it be required at all, cannot well be postponed.

Amount (estimated) required for completion of existing project	$5,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	5,000 00

(See Appendix T 2.)

3. *Mississippi River opposite the city of Saint Louis, Missouri.*—The present project for the improvement of this locality was adopted in 1882, the object being to increase the available length of river front opposite Saint Louis by reclaiming the land occupied by Cahokia Chute, also to stop the erosion at high water of the Illinois shore in Cahokia Chute, and, furthermore, to perpetuate the good results previously obtained under a different project in the channel depth. Before the work was begun a considerable body of water passed through Cahokia Chute at the higher stages, and a small body at low stage, preventing access to the navigable water west of Arsenal Island; a slight erosion of the Illinois shore occured at the higher stages, destroying

land of considerable value; and a portion of the west side of Arsenal Island was in need of protection in order to perpetuate the good channel already existing there. The amount expended during the year, which includes all expenditures to June 30, 1883, was *$47,067.95, and has resulted in partially protecting the west side of Arsenal Island, and in shutting off the water from Cahokia Chute at a stage about 7 feet higher than before. It is proposed during the coming year to complete the protection of the west side of Arsenal Island, and the hurdles employed in silting up the chute.

July 1, 1882, amount available		$60,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$32,900 54	
July 1, 1883, outstanding liabilities	1,003 40	
		33,903 94
July 1, 1883, amount available		26,096 06
Amount (estimated) required for completion of existing project		26,096 06

(See Appendix T 3.)

4. *Mississippi River at or near Cape Girardeau, Missouri, and Minton Point, Illinois.*—The present project for the improvement of this locality was adopted in 1881, the object being to remove a large and growing bar in front of the Cape Girardeau Landing and to provide an 8-foot channel between that place and Minton Point. The bar was dry at a stage 16 feet above low water, and the channel depth was liable to be as little as 4 feet. The amount expended during the year was $21,836.59. The total amount expended to June 30, 1883, is $65,366.55, of which $35,366.55 was added to the special appropriation from the funds provided for improving the Mississippi River between the Illinois and Ohio rivers, and has resulted in wholly removing the bar, and securing a channel to Minton Point, in which the depth during the year has not been less than 8 feet. Further work will be required to perpetuate these results, for which an appropriation is recommended.

Amount (estimated) required for completion of existing project	$41,820 04
Amount that can be profitably expended in fiscal year ending June 30, 1885.	42,000 00

(See Appendix T 4.)

5. *Osage River, Kansas and Missouri.—Below Tuscumbia.*—The present system of improvement employed below Tuscumbia was begun in 1871, the object being to afford a channel of navigable width not less than 2 feet deep.

The natural channel was frequently not more than 6 inches deep at many of the shoals. The amount expended during the year was $1,556.45. The total amount expended to June 30, 1883, is $169,427.02, and has resulted in increasing the depth to at least 2 feet over twenty-one shoals, and removing all snags and overhanging trees.

Above Tuscumbia.—The project for the improvement of the Osage above Tuscumbia was adopted in 1881, the object being to remove all snags and overhanging trees which obstructed navigation. In the natural state of the river many hundreds of these obstructions existed. The amount expended during the year was $8,316.98. The total amount expended to June 30, 1883, is $19,076.34, and has resulted in clearing the natural channel to Osceola, the head of navigation, 230½ miles from

*These figures are obtained by adding to the cash expenditures the cost of the service of equipment.

the mouth. The appropriation of $5,000 asked for is to be applied to the removal of the new supply of these obstacles which is to be expected.

July 1, 1882, amount available		$11,488 51
Miscellaneous receipts		45 57
		11,534 08
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$9,823 56	
July 1, 1883, outstanding liabilities	49 87	
		9,873 43
July 1, 1883, amount available		1,660 65
Amount that can be profitably expended in fiscal year ending June 30, 1885.		5,000 00

(See Appendix T 5.)

REMOVING SNAGS AND WRECKS FROM THE MISSISSIPPI AND MISSOURI RIVERS—IMPROVEMENTS AT VARIOUS POINTS ON MISSOURI RIVER—SURVEY OF MISSOURI RIVER FROM ITS MOUTH TO FORT BENTON—IMPROVEMENT OF GASCONADE RIVER, MISSOURI.

Officer in charge, Maj. Charles R. Suter, Corps of Engineers.

1. *Removing snags and wrecks from the Mississippi and Missouri rivers.*—*Mississippi River.*—During the past season three snag-boats worked on this stream from the mouth of the Missouri to Glasscock's Island, a distance of 1,000 miles. Their aggregate period of service was sixteen and one half months, and the work done gave very general satisfaction. The officer in charge renews his recommendation that the remaining wooden snag-boat be extensively repaired and fitted up for wrecking purposes.

During the present fiscal year operations must of necessity be confined to the limits of the small balance remaining available from last year's appropriation. This will only provide for three months' work, an amount entirely inadequate to meet the wants of navigation.

ESTIMATES.

For repairing one wooden snag-boat and fitting it up for wrecking purposes	$50,000 00
For working expenses of three boats, ten months each, at $4,000 per month	120,000 00
Total	170,000 00

July 1, 1882, amount available		3,812 18
Amount received from sales of fuel to officers		19 12
Amount appropriated by act passed August 2, 1882		85,000 00
		88,831 30
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		69,540 59
July 1, 1883, amount available		19,290 71
Amount that can be profitably expended in fiscal year ending June 30, 1885.		170,000 00

Missouri River.—Two snag-boats were employed on this stream between Kansas City and the mouth, a distance of 375 miles. Their aggregate period of service was six months.

It was not found possible to begin the construction of the new snag-boat authorized, on account of delays in completing the plans, but it is expected that this work will soon be undertaken.

The officer in charge renews his recommendation for the construction

of a light-draught stern-wheel snag-boat for service on the Missouri, and submits an estimate therefor.

The balance remaining of last year's appropriation will only allow of three months' work during the present fiscal year.

ESTIMATES.

For building light-draught snag-boat	$80,000 00
For operating three boats, nine months each, $4,000 per month each	108,000 00
Total	188,000 00
July 1, 1882, amount available	80,000 00
Amount appropriated by act passed August 2, 1882	65,000 00
	145,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	46,661 35
July 1, 1883, amount available	98,338 65
Amount that can be profitably expended in fiscal year ending June 30, 1885	188,000 00

(See Appendix U 1.)

2. *Missouri River between Kansas City and the mouth.*—This work, which consisted of snagging, was continued under the usual snag boat appropriation.

July 1, 1882, balance available, of special appropriation of March 3, 1881	$556 43
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	556 43

(See Appendix U 2.)

3. *Missouri River, from its mouth to Sioux City, Iowa, including such harbors on said river now in the course of improvement as, in the judgment of the Chief of Engineers, will benefit commerce and navigation.*—The general plan proposed for this work contemplated the commencement of a thorough and systematic improvement upon that portion of the river lying between Charleston, Kans., and Lexington, Mo., a distance of 186 miles, and of work under special allotments at such other points as were of sufficient importance to justify the continuance of work already done under special appropriation. The points thus selected were Saint Charles and Glasgow, in Missouri, Nebraska City and Omaha, in Nebraska, and Sioux City, in Iowa. As a matter of prime necessity the procuring of an extensive and efficient plant was also authorized. Much trouble and delay was experienced in this matter, and most of the work done this season has been prosecuted with the old appliances, most of which were worn out or inadequate for economical working. A full and detailed account in this connection will be found in Appendix U. 3.

Of the work authorized at special localities that at Nebraska City, consisting of revetment, was successful, and that at Omaha and Glasgow has not yet been executed. Some dike-work put in at Sioux City was destroyed by the ice, and the same thing happened at Saint Charles, where some unfinished revetment was also destroyed. This latter has since been replaced.

Under the general improvement work of revetment was prosecuted at Saint Joseph, Kansas City, and Lexington, and dike-work was begun at Atchison, all with satisfactory results. Were the money available the approaching completion of the new plant would enable much work of importance to be done during the coming season, but as this is not the case, but little new work will be undertaken, the balance from last year's appropriation being hardly even adequate to watch and preserve

from destruction the work already done, but still incomplete, during the long period which must intervene before additional funds become available.

With the new plant, which will soon be on hand, it is thought that an annual appropriation of $1,000,000 can be economically expended and that the extent and importance of the work will justify the expenditure.

Amount received from sales of fuel to officers		$97 86
Amount appropriated by act passed August 2, 1882		850,000 00
		850,097 86
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$606,970 59	
July 1, 1883, outstanding liabilities	92,927 19	
		699,897 78
July 1, 1883, amount available		150,200 08
Amount (estimated) required for completion of existing project		7,150,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		1,000,000 00

(See Appendix U 3.)

4. *Missouri River at Saint Charles, Missouri.*—No special appropriation was made for this work, and it was carried on by allotment from the general appropriation for improving Missouri River from its mouth to Sioux City, as described under that head in Appendix U 3.

July 1, 1882, amount available	$496 85
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	496 85

(See also Appendix U 4.)

5. *Missouri River at Cedar City, Missouri.*—This work being completed no further work was done, the plant being transferred to Saint Charles.

July 1, 1882, amount available	$310 20
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	310 20

(See Appendix U 5.)

6. *Missouri River at Glasgow, Missouri.*—No special appropriation was made for this work, and it was carried on by allotment from the general appropriation for improving Missouri River from its mouth to Sioux City, as described under that head in Appendix U 3.

July 1, 1882, amount available	$204 92
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	204 92

(See also Appendix U 6.)

7. *Missouri River at Lexington, Missouri.*—No special appropriation was made for this place, which was, however, included in the portion of river selected for general improvement under the appropriation for improving Missouri River from its mouth to Sioux City.

July 1, 1882, amount available	$71 36
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	71 36

(See Appendixes U 3 and U 7.)

8. *Missouri River at Kansas City, Missouri.*—No special appropriation was made for this place, which was, however, included in the portion of

river selected for general improvement under the appropriation for improving Missouri River from its mouth to Sioux City.

July 1, 1882, amount available	$51 27
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	51 27

(See Appendixes U 3 and U 8.)

9. *Missouri River at Fort Leavenworth, Kansas.*—No special appropriation was made for this place, which was, however, included in the portion of river selected for general improvement under the appropriation for improving Missouri River from its mouth to Sioux City.

July 1, 1882, amount available	$39 06
July 1, 1882, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	39 06

(See Appendixes U 3 and U 9.)

10. *Missouri River at Atchison, Kansas.*—No special appropriation was made for this place, which was, however, included in the portion of river selected for general improvement under the appropriation for improving Missouri River from its mouth to Sioux City.

July 1, 1882, amount available	$4,187 14
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4,187 14

(See Appendixes U 3 and U 10.)

11. *Missouri River at Saint Joseph, Missouri.*—No special appropriation was made for this place, which was, however, included in the portion of river selected for general improvement under the appropriation for improving Missouri River from its mouth to Sioux City.

July 1, 1882, amount available	$1,029 59
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	1,029 59

(See Appendixes U 3 and U 11.)

12. *Missouri River at Brownville, Nebraska.*—No special appropriation having been made for this work, it was deemed best to abandon it for the present, the plant, &c., being transferred to Saint Joseph.

July 1, 1882, amount available	$433 38
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	433 38

(See Appendix U 12.)

13. *Missouri River at Eastport, Iowa, and Nebraska City, Nebraska.*—No special appropriation was made for this work, and it was carried on by allotment from the general appropriation for improving Missouri River from its mouth to Sioux City, as described under that head in Appendix U 3.

July 1, 1882, amount available	$826 28
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	826 28

(See also Appendix U 13.]

14. *Missouri River at Plattsmouth, Nebraska.*—No special appropriation having been made for this work it was deemed best to abandon it for the present, the plant being transferred to Nebraska City.

July 1, 1882, amount available	$1,461 19
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	1,461 19

(See Appendix U 14.)

15. *Missouri River at Council Bluffs, Iowa, and Omaha, Nebraska.*—No special appropriation was made for this work, and it was carried on by allotment from the general appropriation for improving Missouri River from its mouth to Sioux City, as described under that head in Appendix U 3.

July 1, 1882, amount available	$9,563 95
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	9,563 95

(See also Appendix U 15.)

16. *Missouri River at Sioux City, Iowa.*—No special appropriation was made for this work and it was carried on by allotment from the general appropriation for improving Missouri River from its mouth to Sioux City.

July 1, 1882, amount available	$481 92
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	481 92

(See Appendixes U 3 and U 16.)

17. *Missouri River at Vermillion, Dakota.*—Work was continued at this point during July and August on the dike described in last annual report. Work was then suspended owing to the unfavorable stage of water. On October 12, the work was turned over to Capt. Edward Maguire, Corps of Engineers.

July 1, 1882, amount available	$4,511 81
October 12, 1882, amount expended to date, exclusive of outstanding liabilities July 1, 1882	4,495 67
October 12, 1882, amount available	16 14

(See Appendix U 17.)

18. *Survey of Missouri River from its mouth to Fort Benton, Montana.*—During the past season the survey was extended from Fort Randall to Fort Pierre, a distance of 192 miles. It has been the intention to renew the field work this spring, but the river and harbor bill having failed to pass, the balance remaining of last year's appropriation was deemed too small for the purpose, and field operations have been suspended pending further action by Congress. The maps of the survey from the mouth to Fort Randall have been completed, and an edition, on a reduced scale of 1 mile to 1 inch, has been published. The maps of last season's work will be completed and published during the current year.

July 1, 1882, amount available	$346 01
Amount appropriated by act passed August 2, 1882	40,000 00
	40,346 01
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	24,733 97
July 1, 1883, amount available	15,612 04
Amount (estimated) required for completion of existing project	65,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	50,000 00

(See Appendix U 18.)

19. *Gasconade River, Missouri.*—On this stream snagging was done from the mouth to Indian Ford, a distance of 78 miles; some dikes were also built at Round Island for channel improvement. The party were in the field from early in September till November 28, 1882, when driven in by the freezing of the river. The work done has greatly improved navigation.

The original estimate of the cost of this improvement was $50,000. The appropriations for the work have amounted to $25,000 to date.

July 1, 1882, amount available	$534 31
Amount appropriated by act passed August 2, 1882	10,000 00
	10,534 31
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	10,025 69
July 1, 1883, amount available	508 62
Amount (estimated) required for completion of existing project	25,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	25,000 00

(See Appendix U 19.)

IMPROVEMENT OF MISSOURI RIVER FROM SIOUX CITY, IOWA, TO FORT BENTON, MONTANA—IMPROVEMENT OF YELLOWSTONE RIVER, DAKOTA AND MONTANA.

Officers in charge, Capt. Edward Maguire, Corps of Engineers, to April 15, 1883; since which time Capt. James B. Quinn, Corps of Engineers.

1. *Missouri River from Sioux City, Iowa, to Fort Benton, Montana.*—During the past seasan work was confined to the river between Fort Benton and Bismarck, and has consisted in the removal of obstructions from the channel, at the several rapids throughout the rocky portions of the river, and construction of wing-dams was necessary to confine the water to main channel. Work has been carried on during the fiscal year at the Grand Island Chute dam and in the dam at the foot of Grand Island, and also in Hammond Island Chute dam and the one above Grand Island.

Repairs were made to the dams at Dauphin's, McGarry's, Snake Point, Two Calf Island and to upper and middle Cow Island dams

The season of work closed October 27, with the completion of Ryan's Island dam.

This improvement is permanent in character, and has resulted in materially increasing the depth of water in the navigable channel, and materially prolonging the period of practicable navigation to Fort Benton. It is proposed to continue this work till it is brought to a successful conclusion; also to attempt the improvement of the sandy portion of the river, where as yet little has been effected, though greatly needing attention.

July 1, 1882, amount available		$1,069 99
Amount appropriated by act passed August 2, 1882		100,000 00
		101,069 99
July 1 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$37,919 72	
July 1, 1883, outstanding liabilities	8,938 35	
		46,858 07
July 1, 1883, amount available		54,211 92
Amount that can be profitably expended in fiscal year ending June 30, 1885.		400,000 00

(See Appendixes V 1 and V 3.)

2. *Yellowstone River, Montana and Dakota.*—During the past season work was confined to the improvement of the channel through Glendive Shoals in the vicinity of Glendive. The dike, 710 feet long, closing the left channel at Katie's Island, bugun last season, was finished, and three other dikes, having an aggregate length of 1,982 feet, were built further

down-stream. In addition a number of small protections were built at low places on the shore to prevent scour.

The effect of the construction of these dikes will be that the entire discharge of the river, at a stage of 1 foot above low water, will flow through one channel and a stretch of river from Glendive to a point 10 miles below will admit of a draught of 4.5 feet water.

During the present season lack of funds will restrict operations to the repair of existing works and an examination of the lower portion of the river, with a view to its subsequent improvement.

July 1, 1882, amount available		$2,115 99
Amount appropriated by act passed August 2, 1882		20,000 00
		22,115 99
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$16,886 42	
July 1, 1883, outstanding liabilities	399 94	
		17,286 36
July 1, 1883, amount available		4,829 63
Amount that can be profitably expended in fiscal year ending June 30, 1885		100,000 00

(See Appendixes V 2 and V 4.)

IMPROVEMENT OF THE NAVIGATION OF THE MISSISSIPPI RIVER BETWEEN SAINT PAUL AND THE MOUTH OF THE ILLINOIS, INCLUDING IMPROVEMENTS AT SPECIAL LOCALITIES BETWEEN THOSE POINTS—IMPROVEMENT OF CUIVRE RIVER, MISSOURI—OPERATING AND CARE OF DES MOINES RAPIDS CANAL.

Officer in charge, Maj. A. Mackenzie, Corps of Engineers.

1. *Upper Mississippi River, operations of snag-boat, &c.*—During the year the United States snag-boat General Barnard was employed as heretofore in removing snags and other obstructions and in making surveys for future improvements. The new light-draught snag-boat, the J. G. Parke, built under appropriation of March 3, 1881, came out in July, 1882, and has proved very serviceable. During a part of last year she was used for towing barges engaged in transporting material to the site of the works at Guttenberg and Fort Madison. Her cost fully equipped was $22,000.

The small amount still available will be used in the low-water season, at which time the greatest amount of good can be accomplished.

The officer in charge submits an estimate of $30,000 for running the boats and making repairs during the fiscal year ending June 30, 1885, which amount cannot be materially reduced without impairing their usefulness.

July 1, 1882, amount available		$1,374 94
Amount appropriated by act passed August 2, 1882		25,000 00
		26,374 94
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		16,187 08
July 1, 1883, amount available		10,187 86
Amount that can be profitably expended in fiscal year ending June 30, 1885		30,000 00

(See Appendix W 1.)

2. *Mississippi River from Saint Paul to the Des Moines Rapids.*—During the year the work of improvement was carried on in the construction of brush and stone dams and shore protections between Saint Paul and Hastings, Minn.; Alma, Wis., and Wabasha, Minn.; Homer, Minn., and

Queen's Bluff, Minn.; Mount Vernon, Minn., and Fountain City, Wis.; La Crosse, Wis, and Brownsville, Minn.; at Guttenberg, Cassville Slough, Rush Chute, Shokokon Slough, and Montrose, Iowa.

It is proposed to employ the funds now available from appropriation of August 2, 1882, in finishing work begun last season between Saint Paul and Hastings, and between Alma and Wabasha, and in making necessary repairs to work constructed in former years. On account of the small amount at present available, no new work can be inaugurated.

The officer in charge recommends an appropriation of $1,000,000 for continuing the improvement of the river between Saint Paul and Des Moines Rapids for the fiscal year ending June 30, 1885.

The work of former years has been productive of the best results, and is no longer in an experimental stage, and the Government now being provided with four complete equipments of its own in the way of steamboats, barges, pile drivers, quarter-boats, &c., will be able to expend to great advantage and very economically the amount asked for.

July 1, 1882, amount available		$21,399 91
Amount appropriated by act passed August 2, 1882		250,000 00
		271,399 91
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$167,066 61	
July 1, 1883, outstanding liabilities	523 34	
		167,589 95
July 1, 1883, amount available		103,749 96
Amount that can be profitably expended in fiscal year ending June 30, 1885.		1,000,000 00

(See Appendix W 2.)

3. *Mississippi River from Des Moines Rapids to mouth of Illinois River.*—During the year works of improvement by means of brush and stone dams and shore protections were carried on at Gregory's Landing, Quincy, Ill., Hannibal, Mo., Louisiana, Mo., Cap au Gris, Mo., Boeters and Dardenne islands.

It is proposed with the funds now available from appropriation of August 2, 1882, to complete the works already begun at Quincy, Hannibal, Louisiana, and Cap au Gris, but the amount is too small to inaugurate much new work. It is proposed, however, to close Bayou Saint Charles at its head near Marion City, and to protect a badly caving bank above Hannibal.

The officer in charge recommends on appropriation of $500,000 for continuing the improvement of the Mississippi River between Des Moines Rapids and the mouth of the Illinois River for the fiscal year ending June 30, 1885.

The work of former years has been productive of excellent results, and the Government is now provided with a large and well-equipped plant, and will be able to expend to great advantage the amount asked for.

July 1, 1882, amount available		$47,479 67
Amount appropriated by act passed August 2, 1882		200,000 00
		247,479 67
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$97,073 84	
July 1, 1883, outstanding liabilities	5,978 82	
		103,052 66
July 1, 1883, amount available		144,427 01
Amount that can be profitably expended in fiscal year ending June 30, 1885.		500,000 00

(See Appendix W 3.)

4. *Harbors of Refuge on Lake Pepin.*—The project for this work proposes the building of breakwaters at Stockholm and Lake City to protect and facilitate the landing of steamboats, and which will admit of such extension in the future as to afford safety to rafts caught in the lake by storms.

The estimate is as follows: for Lake City, $154,583; for Stockholm, $73,370; total, $227,953. The amount appropriated by act of August 2, 1882, was too small to justify a beginning.

The officer in charge recommends either a revision of the plans, or the appropriation of a sum sufficient to justify commencement of such work as Congress may consider warranted.

Amount appropriated by act of August 2, 1882	$20,000 00
July 1, 1883, amount available	20,000 00
Amount (estimated) required for completion of existing project	208,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	208,000 00

(See Appendix W 4.)

5. *Mississippi River at Guttenberg, Iowa.*—The project for this work, which embraced the construction of a dam across Swift Slough and the protection of a part of the western shore of the island, has been carried out. No further appropriation is asked for.

July 1, 1882, amount available	$2,527 28
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	2,527 28

(See Appendix W 5.)

6. *Removal of bar in Mississippi River opposite Dubuque, Iowa.*—Nothing was done during the year except a survey of the bar. The work heretofore accomplished consisted in dredging away the bar in front of the Dubuque Levee, thereby affording ample depth of water at all stages of the river.

An examination is now in progress to ascertain if the bar is forming again. If such be the case, a portion of the funds available will be used in dredging.

As the balance available will be sufficient for the fiscal year ending June 30, 1885, no appropriation is asked for, for that period.

July 1, 1882, amount available		$10,755 10
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	380 78	
July 1, 1883, amount available		10,374 32
Amount (estimated) required for completion of existing project		9,770 03

(See Appendix W 6.)

7. *Ice harbor at Dubuque, Iowa.*—The project for a winter harbor at Dubuque proposed the dredging of Waple's Cut, a natural basin at Dubuque, so as to afford 6 feet at extreme low water over an area of about 500,000 square feet. This will afford ample accommodation for all the steamboats, barges, and rafts at present likely to use it for a winter harbor.

The estimate for the work is $40,000.

Under appropriation of August 2, 1882, dredging is now going on under contract, and the balance available will be exhausted in August, 1883.

The officer in charge recommends for completing the work the granting of the remainder of the estimate ($20,000) for the fiscal year ending June 30, 1885.

Amount appropriated by act passed August 2, 1882		$20,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$11,051 62	
July 1, 1883, outstanding liabilities	1,107 70	
		12,159 32
July 1, 1883, amount available		7,840 68
Amount (estimated) required for completion of existing project		20,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		20,000 00

(See Appendix W 7.)

8. *Rock Island Rapids, Mississippi River.*—During the past year the system of buoys for guidance of navigators was maintained. A survey of Duck Creek Chain developed the existence of certain patches of rock above grade, the estimated cost of removing which is $8,000. To provide for the removal of this rock and for the expense of maintenance of buoys and permanent channel marks, and for the continuance of such inspection and superintendence as is required in the interest of present and future navigation, the officer in charge recommends an appropriation of $13,000 for the fiscal year ending June 30, 1885.

July 1, 1882, amount available	$4,990 83
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	2,836 64
July 1, 1883, amount available	2,154 19
Amount that can be profitably expended in fiscal year ending June 30, 1885	13,000 00

(See Appendix W 8.)

9. *Harbor at Rock Island, Illinois.*—No work was done during the past year, and no money expended. An examination will be made in the fall to ascertain the condition of the harbor. The funds now available being sufficient for the fiscal year ending June 30, 1885, no appropriation is asked for.

July 1, 1882, amount available	$6,669 62
July 1, 1883, amount available	6,669 62
Amount (estimated) required for completion of existing project	14,759 15

(See Appendix W 9.)

10. *Mississippi River at Andalusia, Illinois.*—The object of this improvement is, by the construction of several dams and shore protections, to open up and maintain a good landing for steamboats at all stages of the river at this point.

The closing of Andalusia Slough, which is a part of the project, will greatly benefit the main channel of the river.

The amount asked for ($12,000) is to be applied to the completion of the improvement.

July 1, 1882, amount available	$575 79
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	575 79
Amount (estimated) required for completion of existing project	12,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885:	12,000 00

(See Appendix W 10.)

11. *Harbor at Muscatine, Iowa.*—The object of this improvement is by dredging to keep the steamboat landings free from deposit. The harbor being in good condition, no work was done.

The funds available will be sufficient to complete the project as originally proposed, and no further appropriation is asked for.

July 1, 1882, amount available	$420 26
Amount appropriated by act passed August 2, 1882	2,500 00
July 1, 1883, amount available	2,920 26

(See Appendix W 11.)

12. *Harbor at Fort Madison, Iowa.*—Shore protection to the amount of 1,500 linear feet was built during the past year. The object of the improvement is by a system of dams and shore protections to confine the channel to the Fort Madison shore.

No funds are at present available.

To complete the original project the sum of $6,100 is asked for for the fiscal year ending June 30, 1885.

July 1, 1882, amount available	$2,274 25
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	2,274 25
Amount (estimated) required for completion of existing project	6,100 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	6,100 00

(See Appendix W 12.)

13. *Des Moines Rapids, Mississippi River.*—This work, which has for its object the improvement of navigation on the Des Moines Rapids, was begun in 1866. The adopted plan consisted in building a canal 8 miles long, and in cutting a channel in the rocky bottom of the river the remaining 4 miles. The canal was opened August, 1877, although not fully completed, and has been in operation since that time.

The work of the past year consisted in removing by dredge 1,529.9 cubic yards of rock from the channel of the rapids between Montrose and Nashville, and the laying of 14,222 square yards of riprap face-wall in the canal. Raising the lower lock walls was begun. The funds available will be expended in continuing above work.

The original estimate for this improvement was $4,450,935. This project was modified as explained in last year's report, and the sum of $41,745 added, making the amount of existing project $4,492,680.

There has been expended on this work up to present date $4,372,-824.27; there is now on hand a balance of $23,110.73, and there is required to complete the work, as shown by figures given, $96,745.

The good of the work requires that this amount be appropriated for fiscal year ending June 30, 1885, in order that arrangements may be made for completing the work within a reasonable time.

July 1, 1882, amount available	$30,247 17
Amount appropriated by act passed August 2, 1882	30,000 00
	60,247 17
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	37,136 44
July 1, 1883, amount available	23,110 73
Amount (estimated) required for completion of existing project	96,745 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	97,000 00

(See Appendix W 13.)

14. *Operating and care of Des Moines Rapids Canal.*—During the year the canal was operated, as heretofore, in the interest of navigation at such times as the stage of water in the river necessitated and permitted its use. The high water of the year, as well as of the year previous, was of long duration, and boats were enabled to run the rapids for a much longer space of time than commonly.

There passed through the canal 1,107 steamboats and 705 barges, car-

rying 9,192 passengers, 43,359 tons merchandise, and 729,174 bushels of grain; 15,000,000 feet of lumber and logs were also floated through the canal.

A small force was kept busy during most of the working season in repairing and refilling canal embankment.

A great part of the accumulated deposits of sand, especially at Price's, Ballinger's, and Lamallee's creeks, were removed by dredging, 91,000 cubic yards being taken out by contract and 30,000 cubic yards by the United States dredge. About 21,000 cubic yards of sand and broken rock were removed from the open canal between Montrose and Nashville. The machine shop at the lower lock operated by the regular canal force performed excellent service in making repairs to lock machinery, &c., and in rebuilding the steam-launch.

There has been expended to July 1, 1883, for operating and care of canal, $277,262.96. There was expended during the year $69,638.31 (exclusive of liabilities July 1, 1882), from which must be deducted $31,374.66, being extraordinary expenses of dredging and repair to guard lock gates, leaving $38,263.65 as the ordinary expense of operating and care and repairs to embankments, &c. The standing estimate for operating and care, including ordinary repairs, is $40,000 per annum. The future expenses of the canal are provided for in the act of March 3, 1881, which authorizes the Secretary of War to draw from the Treasury from time to time such amounts as may be needed.

July 1, 1882, amount available		$3,228 83
Amount received from Treasury during year ending June 30, 1883		75,000 00
		78,228 83
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$69,638 31	
July 1, 1883, outstanding liabilities	8,288 48	
		77,926 79
July 1, 1883, amount available		302 04
Amount that can be profitably expended in fiscal year ending June 30, 1885		49,500 00

(See Appendix W 14.)

15. *Dry-dock at Des Moines Rapids Canal.*—The project for this work provides for the building of a dry-dock near the middle lock of the canal, 400 feet long by 100 feet in width, with gates of 80 feet opening. The estimate of cost is $125,000. High water delayed work during the year, but a large amount of material has been collected, and everything is in readiness for carrying on operations vigorously during the coming low-water season.

Amount appropriated by act passed August 2, 1882		$30,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		5,392 95
July 1, 1883, amount available		24,607 05
Amount (estimated) required for completion of existing project		95,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		95,000 00

(See Appendix W 15.)

16. *Mississippi River near Alexandria, Missouri.*—The project for this work proposes to give 5 feet at low water on the bar known as the Warsaw Crossing, by the construction of several wing-dams. The estimate for the work was $30,945.75. Of this amount the sum of $16,000 has been expended to date in the construction of two wing-dams ex-

tending from the Missouri shore, and the object sought has been obtained by this partial execution of the project.

It is not believed that further funds will be needed other than those that may be applied from time to time from the general appropriation from "Des Moines Rapids to Illinois River."

No work in the field was done during past year.

July 1, 1882, amount available	$210 06
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	210 06
Amount (estimated) required for completion of existing project	14,945 75

(See Appendix W 16.)

17. *Mississippi River at Quincy, Illinois.*—The original project contemplated the improvement of the troublesome bar in front of the city. Two wing-dams extending from the Missouri shore were constructed in 1879, and since that time the river has been in excellent condition and it was thought best to withhold the project for expenditure of the balance available July 1, 1882, and accordingly no work was done during the year. The balance available July 1, 1883, will be sufficient to carry on work for fiscal year ending June 30, 1885, and no further appropriation is asked for for that year.

July 1, 1882, amount available	$12,526 22
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	35 00
July 1, 1883, amount available	12,491 22

(See Appendix W 17.)

18. *Quincy Bay, Illinois.* The original project for this work was presented in 1879, and contemplated the expenditure of $224,000. The work proposed was the dredging of about 700,000 cubic yards of material, some shore-protections, &c., in order to afford a large and safe winter harbor capable of accommodating all the vessels that may seek refuge there. The amount expended to date on this project is $45,000, which has resulted in the removal of 206,000 cubic yards of material, and affords a depth of 4½ feet at low water over an area of about eighty acres. During the year the amount ($15,000) appropriated by act of August 2, 1882, was expended in dredging 54,434 cubic yards of material.

For further dredging an appropriation of $50,000 is asked for by the officer in charge, for fiscal year ending June 30, 1885.

Amount appropriated by act passed August 2, 1882	$15,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	14,797 89
July 1, 1883, amount available	202 11
Amount (estimated) required for completion of existing project	154,109 87
Amount that can be profitably expended in fiscal year ending June 30, 1885	50,000 00

(See Appendix W 18.)

19. *Mississippi River at Hannibal, Missouri.*—The original project for this work, submitted in January, 1880, contemplated, at a cost of $60,000, the removal by dredging of large gravel and mud bars in front of Hannibal, and the construction of three spur-dams and one closing-dam on the Illinois side, to confine the channel to the Missouri shore and prevent the bars from reforming.

The amount expended to July 1, 1883, under this head of appropriation, is $45,000, and has resulted in the removal of nearly all of the bars and the building of one wing and one closing-dam, which have devel-

oped a strong current along the Hannibal shore and will keep the levee in future free from deposits of mud and sand.

To complete the original project two more wing-dams must be built, one of which to be in the form of a causeway, in order that the ferry-boat may make use of it in times of low water. This latter work was begun during the past year with funds allotted from the general appropriation from "Des Moines Rapids to Illinois River."

The officer in charge asks for an appropriation of $15,000 to complete the improvement.

Amount (estimated) required for completion of existing project.....	$15,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	15,000 00

(See Appendix W 19.)

20. *Mississippi River at Louisiana, Missouri.*—The original project contemplates the improvement of the channel of the river in vicinity of Louisiana, so as to afford 6 feet at low water, by the construction of several dams and shore protections, the estimate for which is $55,000.

No money was appropriated by the act of August, 1882, but as the situation was very urgent, the river being badly obstructed by sand-bars below Louisiana bridge, an allotment of funds sufficient to complete the original project was made from the general appropriation from "Des Moines Rapids to Illinois River."

No further appropriation is asked for.

(See Appendix W 20.)

21. *Cuivre River, Missouri.*—The original project for this work at an estimated cost of $30,000 contemplated the improvement of Cuivre River and Cuivre Slough from its junction with the Mississippi to Chain of Rocks, about 16½ miles, so as to give at extreme low water a depth of at least 2 feet. The works consisted in dredging, removing snags, &c., and closing slough.

The amount expended to date is $12,000, and has resulted in the completion of the dredging and the removal of the snags. During the past year, under appropriation of August 2, 1882, dredging was continued and this part of the project completed. To complete the project requires the construction of the dam across Cuivre Slough, which, in addition to its effect on the Cuivre, would doubtless also benefit the navigation of the Mississippi itself in that vicinity, and therefore the officer in charge recommends the appropriation of funds sufficient to complete the project.

Amount appropriated by act passed August 2, 1882.....	$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	5,000 00
Amount (estimated) required for completion of existing project	18,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	18,000 00

(See Appendix W 21.)

TEST OF THE ADAMS FLUME.

Preliminary arrangements by Mr. M. J. Adams, for making a practical test of the flume invented by him for improving rivers, for which there was appropriated by act of March 3, 1879, $20,000, to be expended under his direction, and an additional appropriation of $8,000 by act of August 2, 1882, have been continued during the year. The expenditures by the inventor to the close of the fiscal year amount to $23,019.24, and there remained at that time $4,980.76 for completion of his arrangements in which he is still engaged.

PRESERVATION OF THE FALLS OF SAINT ANTHONY AND IMPROVEMENT OF THE MISSISSIPPI ABOVE THE FALLS—IMPROVEMENT OF CHIPPEWA AND SAINT CROIX RIVERS, WISCONSIN, AND OF MINNESOTA RIVER AND RED RIVER OF THE NORTH, MINNESOTA AND DAKOTA—RESERVOIRS AT THE SOURCES OF THE MISSISSIPPI.

Officer in charge, Maj. C. J. Allen, Corps of Engineers.

1. *Preservation of Falls of Saint Anthony, Minnesota.*—The plan under which work has been carried on during the past fiscal year is a continuation of the original plan which contemplated the protection and preservation of the limestone ledge forming the bed of the river above the crest of the falls by means of a concrete dike, to prevent percolation, and extending entirely across the width of the river underneath the ledge and resting upon sand rock which forms a layer or stratum of indefinite depth beneath the ledge; the construction of rolling dams to keep the upper surface of the limestone flooded during the winter; and a timber apron and wings to prevent the retrocession of the crest of the falls and consequent destruction of the dike.

The work during the fiscal year consisted mainly in repairing and strengthening the apron at its easterly end, or at what is known as the angle. Examination of the river bed at the angle made in September last showed that an area of 100 feet by 80 feet had been scoured to an average depth of 8 feet since the examination of August, 1881. This scour was partly due to prolonged high water, the floods being forced, on account of contraction of the bed of the stream by private works, to discharge mainly through a channel about one-third the natural width of the stream and under a head of 42 to 45 feet; but the principal scour was due to further contraction of the channel by masses of stone, clay, and other material thrown into the stream by private parties.

The scour and undermining rendered extensive repairs necessary. A large portion of the apron in the angle was replanked, and two new cribs sunk under the toe of the apron to replace timber work destroyed. One of the cribs was 67 feet long by 26 feet in width, and 28 to 33 feet in depth; the other 8 feet long by 20 in width and 26 in depth; both filled with stone and well tied in with the rest of the timber work. In addition, the bed of the river at the angle was riprapped with heavy stone over an area of about 120 feet square and to an average depth of 9 feet, and upon this mass of riprap was sunk a tight crib 80 feet square and 6 feet in depth, to serve both as a buttress and mattress.

The sum of $50,000 will be required for the fiscal year ending June 30, 1885, in order to meet damage to the works from floods and other causes and to extend the line of submerged crib at the toe of the apron entirely across the river.

Amount expended during the year ending June 30, 1883, $33,966.93.

Total amount expended to June 30, 1883, which includes amounts expended under original and present projects, &c. (including outstanding liabilities), $603,538.78.

July 1, 1882, amount available		$11,428 15
Amount appropriated by act passed August 2, 1882		25,000 00
		36,428 15
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$34,653 57	
July 1, 1883, outstanding liabilities	313 36	
		34,966 93
July 1, 1883, amount available		1,461 22

Amount (estimated) required for completion of existing project..... $134,726 31
Amount that can be profitably expended in fiscal year ending June 30, 1885. 50,000 00

(See Appendix X 1.)

2. *Mississippi River above the Falls of Saint Anthony, Minnesota.*—The plan under which this work is carried on is based upon a project for the improvement of the stretch of river from Conradis Shoals (35 miles below Brainerd) to Grand Rapids, the estimate being $54,127.50.

The first appropriation ($15,000) was made June 14, 1880.

The amount expended under this plan to June 30, 1883, is $28,968.20, the work having been mainly confined to the river between Aitken, on the Northern Pacific Railroad, and Grand Rapids. Some bowlders were, however, removed from the channel of the river at the Little Winnibigoshish Rapids, to facilitate the running of the United States steamboat, barges, and flats.

The work during the past fiscal year consisted in the removal of bowlders, snags, and leaning trees. As the result of the work to date, all the rapids have been cleared of the worst bowlders, and about two-thirds of the river from Aitken to Grand Rapids cleared of overhanging trees and snags. At mean low water boats drawing 3 feet can run from Aitken to Grand Rapids. Both of these places furnish supplies to extensive lumber camps in Northern Minnesota.

With the balance available June 30, it is proposed to continue the work during the season of 1883 so far as the funds will admit.

The sum of $10,000 can be profitably expended during the fiscal year ending June 30, 1885, in further removal of obstructions.

July 1, 1882, amount available		$3,359 27
Amount appropriated by act passed August 2, 1882		10,000 00
		13,359 27
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$6,613 15	
July 1, 1883, outstanding liabilities	714 32	
		7,327 47
July 1, 1883, amount available, viz: improvement between Grand Rapids and Conradis Shoals		6,031 80
Amount (estimated) required for completion of existing project		19,127 50
Amount that can be profitably expended in fiscal year ending June 30, 1885.		10,000 00

(See Appendix X 2.)

3. *Construction of lock and dam on Mississippi River at Meeker's Island, Minnesota.*—The project for this work is given in the report of the Chief of Engineers for the fiscal year ending June 30, 1874, and the cost estimated at $922,121.46, the object being to connect with the improvement of the Mississippi River below Saint Paul, so as to secure steamboat navigation up to the Falls of Saint Anthony.

No improvement of the river between Saint Paul and the site of the proposed lock and dam has been authorized by Congress.

The act approved July 23, 1868, made a grant of 200,000 acres of public lands to the State of Minnesota to aid in constructing a lock and dam at this point in accordance with plan and estimate previously submitted.

The act of March 3, 1873, appropriated—

For construction of the lock and dam on the Mississippi River at Meeker's Island, Minnesota, according to the surveys and plans of the War Department, twenty-five thousand dollars: *Provided*, That all rights and claims in and to the land grant made to the State of Minnesota for the above work by act approved July twenty-third, one thousand eight hundred and sixty-eight, shall be fully relinquished to the United States before any of this appropriation is expended.

None of this appropriation has been used, the required relinquishment not having been made, and the appropriation has been lying unused for ten years.

No appropriation is recommended for the fiscal year ending June 30, 1885.

July 1, 1882, amount available	$25,000 00
July 1, 1883, amount available	25,000 00
Amount (estimated) required for completion of existing project	922,121 46

(See Appendix X 3.)

4. *Chippewa River, Wisconsin.*—This work consists in the construction of dams and jetties to narrow the waterway, and revetment of banks with brush and stone, in accordance with the original plan of improvement, the cost of which was based upon the report of January 30, 1875. During the fiscal year repairs were made to the jetties at the mouth of the river, and work was also done at Flower Pot Bar, Three Mile Prairie, Little Missouri Dam, Wacouta Island Dam, Twin Island Dam; and the dangerous cut-off at Dead Lake, near the entrance to Beef Slough, was entirely closed by means of a heavy dam of fascines and stone. With the balance of funds remaining from the appropriation of $35,000 by act of August 2, 1882, work will be resumed during the coming season of low water. The appropriation will be exhausted by the close of the season. The original estimate of 1875 for the improvement of the stretch of river under consideration, viz, below Eau Claire, contained an item $64,102.50 for the protection of the Yellow Banks. This latter was made by act of August last a separate work. The estimate of 1875 for channel improvement alone was $75,790. Revised estimates place the cost of completing the improvement at $49,476.35.

The sum of $35,000 can be profitably expended during the fiscal year ending June 30, 1885, in furtherance of the present plan.

The work to date has been highly beneficial to the navigation of the river. Where the depth of water was but 16 to 18 inches before any works of improvement were constructed, there is now, in the vicinity of the works, 3 feet least depth at low water.

The total amount expended to June 30, 1883, including outstanding liabilities, is $76,476.87.

July 1, 1882, amount available		$505 23
Amount appropriated by act passed August 2, 1882		35,000 00
		35,505 23
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$26,736 59	
July 1, 1883, outstanding liabilities	2,245 51	
		28,982 10
July 1, 1883, amount available		6,523 13
Amount (estimated) required for completion of improvement as per revised estimate		49,476 35
Amount that can be profitably expended in fiscal year ending June 30, 1885.		35,000 00

(See Appendix X 4.)

5. *Chippewa River at Yellow Banks, Wisconsin.*—The object of this work is to prevent the wearing away of the high sand-banks or bluffs on the Chippewa River below Eau Claire, and thereby relieve this river, as well as the Mississippi River below the Chippewa, from the immense quantities of sand constantly sliding into the stream as the slopes are scoured by the action of the current. There are five banks, counting from Eau Claire to the mouth of the river, whose aggregate length re-

quiring protection is 24,000 feet. The protection of these banks was considered in the original estimate for improving the Chippewa River, the cost of protecting the banks being then placed at $64,102.50.

Operations were begun on the Waubeek Bank, the one nearest the mouth of the river, early in May following, and at the close of the fiscal year 1,200 linear feet were completed and 500 linear feet partly completed. The protection work consists of revetment of brush, edgings, and piles at foot of slope, and in terracing the faces of the slopes.

With the balance of funds available the work will be pushed during the coming season.

The cost of this work, based upon experience gained since its commencement, is now put at $4 per linear foot, or $96,000 for the five banks.

The total amount expended to June 30, 1883, including outstanding liabilities, is $13,120.70.

Amount appropriated by act passed August 2, 1882		$30,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$4,054 64	
July 1, 1883, outstanding liabilities	9,066 06	
		13,120 70
July 1, 1883, amount available		16,879 30
Amount (estimated) required for completion of improvement per revised estimate		66,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		30,000 00

(See Appendix X 5.)

6. *Saint Croix River below Taylor's Falls, Minnesota and Wisconsin* — The plan for this work, adopted in 1878, contemplated the improvement of the stream by the removal of snags, bowlders, wrecks, leaning trees, and bars between Taylor's Falls and Prescott; and the contraction of the low-water channel between Taylor's Falls and Prescott into one of nearly uniform width by means of jetties, and dams of brush and stone to close island chutes.

The work during the fiscal year has consisted in the removal of snags, trees, stumps, and six cribs, and one wreck from the channel, and the building of dams and shore protection. Below Stillwater a pile and plank dam was commenced at Hudson Bar for the purpose of collecting the water, at low stage, into one channel, and to serve as a sheer to prevent rafts being driven upon the bar. A channel was partially excavated at Catfish Bar, 7 miles below Hudson. During the coming season, work will be continued above Stillwater, and that at Hudson will it is expected, be finished, and that at Catfish Bar completed so far as the excavation is concerned. It is not likely that funds enough will be left to warrant the commencement of the proposed brush dam at the latter-named bar. Hudson and Catfish bars are both in Lake Saint Croix, which is in reality an enlargement of the river.

On the Saint Croix, as on other rivers where steamboat, barge, and loose log navigation occur, there is a conflict of interests. During a portion of the season of 1882 boats were completely blocked out from certain portions of the stream, and the same trouble has arisen this summer. So that, while the work of improvement is of general benefit for about four or five months of the year, for about two months the benefit above Stillwater is much restricted. Boats drawing 3 feet can, at low water, run from Stillwater to Taylor's Falls, excepting when the booms are closed; and 4 feet depth at low water can be carried from Stillwater to Prescott, the depth to be increased by the close of this season by about 2 feet.

The sum of $35,500 can be profitably expended, in pursuance of the present plan, during the fiscal year ending June 30, 1885.

Estimated cost of present project		$83,450 00
Amount expended before its adoption		18,000 00
Total amount expended to June 30, 1883, including outstanding liabilities		53,325 33
July 1, 1882, amount available		23 57
Amount appropriated by act passed August 2, 1882		30,000 00
		30,023 57
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$16,150 80	
July 1, 1883, outstanding liabilities	1,198 10	
		17,348 90
July 1, 1883, amount available		12,674 67
Amount (estimated) required for completion of existing project		35,450 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		35,500 00

(See Appendix X 6.)

7. *Minnesota River, Minnesota.*—No work was done during the fiscal year for want of funds.

The last appropriation for this stream was $10,000, made by the river and harbor act of June 18, 1878. There has been expended since the commencement of work the sum of $117,458 in clearing the river of obstructions. The stream has no commerce worth reporting. No appropriation is asked for the fiscal year ending June 30, 1885.

July 1, 1882, amount available	$33 00
July 1, 1883, amount available	33 00
Amount (estimated) required for completion of existing project	733,868 63

(See Appendix X 7.)

8. *Red River of the North, Minnesota and Dakota.*—The plan of improvement consists in dredging the clay bars and mud lumps, and removal of snags, &c., from Breckenridge to the boundary line between the United States and Manitoba.

The act of August 2, 1882, appropriated $10,000 for continuing the improvement. With this sum and the balance from former appropriations the work of dredging and removal of bowlders and snags was resumed. By the close of the year 17 miles had been dredged between Moorhead and Goose Rapids, and 18 miles below Grand Forks; and snags, stumps, and overhanging trees removed from the channel; and, in addition, 321 cubic yards of the worst bowlders removed from Goose Rapids. Since the commencement of dredging in 1879 to date the dredges have worked over 98 miles of river, affording for a distance of 80 miles below Moorhead an assured navigation with dredged channels from 60 to 80 feet in width, and depth of 3 feet at lowest water, and 18 miles of 4-foot channel dredged below Grand Forks.

The shipment of grain by river has largely increased since 1879.

A revised estimate for improvement from Breckenridge to the boundary line, not including lock and dam at Goose Rapids, submitted by the officer in charge, places the cost at $66,310.18.

The total amount expended to June 30, 1883, including outstanding liabilities, is $108,495.98.

The balance of funds available from appropriations, at the close of the fiscal year, being only sufficient for the care of the dredges and other property, the work must remain suspended until another appropriation is made.

July 1, 1882, amount available	$12,137 55
Amount appropriated by act passed August 2, 1882	10,000 00
	22,137 55
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	17,633 53
July 1, 1883, amount available	4,504 02
Amount (estimated) required for completion of improvement per revised estimate, not including lock and dam at Goose Rapids	66,310 18
Amount that can be profitably expended in fiscal year ending June 30, 1885	30,000 00

(See Appendix X 8.)

9. *Lock and Dam at Goose Rapids on Red River of the North, Minnesota and Dakota.*—The cost of this work was originally estimated at $200,000.

The act of March 3, 1881, appropriated $20,000, and that of August 2, 1882, $30,000 for it.

Examinations of the rapids were made during the fall and early part of the winter at several points in order to fix upon a locality at which a single lock and dam would prove of most benefit. The sum of the two appropriations is too small in proportion to the probable cost (which it is now apparent will not be short of $250,000) to admit of making a beginning on this work.

The officer in charge is engaged in preparing a new estimate of cost of the work. Should it be commenced the sum of $100,000, in addition to the sums already appropriated, can be profitably expended during the fiscal year ending June 30, 1885.

The amount expended during the year ending June 30, 1883, is $595.24, which represents also the *total* amount expended to June 30, 1883.

July 1, 1882, amount available	$20,000 00
Amount appropriated by act passed August 2, 1882	30,000 00
	50,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	595 24
July 1, 1883, amount available	49,404 76
Amount (estimated) required for completion of project, per revised estimate	200,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	100,000 00

(See Appendix X 9.)

10. *Reservoirs upon the headwaters of the Mississippi River and its tributaries.*—During the year work has progressed upon the Winnibigoshish and Leech Lake dams, and has been commenced upon that at Pokegama Falls.

The Winnibigoshish dam is to have a lift of 14 feet, creating a reservoir of 45,000,000,000 cubic feet capacity. Its cost, including diking, is placed at $160,000. It is about two-thirds completed.

The Leech Lake dam, to raise the water of Leech Lake 4 feet, creating a reservoir of 22,000,000,000 cubic feet capacity, was begun in September, 1882. Its cost is placed at $80,000. It is about one-half completed.

The Pokegama dam, to have a lift of 7 feet and create a reservoir of 3,500,000,000 cubic feet capacity, was not commenced until June, 1883, delays in obtaining releases against damage from overflow having prevented an earlier beginning. The cost of this dam is placed at $50,000.

It is expected that the accumulation of water in the Winnibigoshish

and Leech Lake reservoirs will commence during the latter part of the coming autumn.

The cost of the proposed reservoirs upon the headwaters of the Mississippi River and its tributaries, as originally estimated, is placed at $1,809,083, this sum being exclusive of damages from overflow, a quantity that cannot be estimated with certainty in advance.

The object of the reservoirs is to store up the surplus waters of spring and early summer to be systematically released in aid of navigation during the period of drought or low water.

A plan for the construction of a reservoir dam below the mouth of the Vermillion River, a tributary of the Mississippi above Pokegama Falls, is under consideration. The dam to have a lift of 10 feet, creating a reservoir of about 5,700,000,000 cubic feet capacity, and to cost $130,000.

The cost of the Pine River and Gull River reservoirs, tributary to the Mississippi River above Saint Paul, is placed as follows:

For the Pine River reservoirs	$124,158 09
For the Gull River reservoirs	63,857 37

The sum of $200,000 is estimated as the amount necessary, in addition to the sums already appropriated, for the completion of the system on the Mississippi River above Saint Paul, which can be profitably expended during the fiscal year ending June 30, 1885. The cost of all the dams and reservoirs, as given, is exclusive of cost of damages.

With the balance of funds from appropriations, to date, it is proposed to continue work upon the dams already commenced and to commence the work upon the proposed dam below the mouth of the Vermillion River as soon as the question of damage to Indian lands can be settled.

Total amount expended to June 30, 1883 (including outstanding liabilities), is $212,881.33.

July 1, 1882, amount available		$140,713 05
Amount appropriated by act passed August 2, 1882		300,000 00
		440,713 05
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$114,082 76	
July 1, 1883, outstanding liabilities	14,511 62	
		128,594 38
July 1, 1883, amount available		312,118 67
Amount (estimated) required for completion of existing project		1,284,083 50
Amount that can be profitably expended in fiscal year ending June 30, 1885.		200,000 00

(See Appendix X 10.)

11. *Surveys for reservoirs at the sources of the Mississippi, Saint Croix, Chippewa, and Wisconsin rivers.*—The officer in charge reports that if the reservoir work now begun in Minnesota at the headwaters of the Mississippi River is to extend to the Saint Croix, Chippewa, and Wisconsin rivers, it will be necessary, in order to meet questions constantly arising as well as to be enabled to make closer estimates of cost of dams, &c., to continue hydrological observations, to continue borings at proposed dam sites, to recontour some of the sites, and to work up maps, drawings, and estimates. He estimates the cost of such examinations for one year at $49,000. There having been no appropriation for such work during the past fiscal year nothing was done under this head.

Amount that can be profitably expended in fiscal year ending June 30, 1885... $50,000

(See Appendix X 11.)

IMPROVEMENT OF TENNESSEE AND CUMBERLAND RIVERS AND OF CERTAIN RIVERS IN EASTERN TENNESSEE, GEORGIA, AND KENTUCKY.

Officer in charge, Maj. W. R. King, Corps of Engineers, with Capt. L. C. Overman, Corps of Engineers, under his immediate orders, to November 1, 1882, and Lieut. T. A. Bingham, Corps of Engineers, during the fiscal year.

1. *Tennessee River.*—*a. Above Chattanooga.*—Examinations of this river were made in 1830, and again in 1872, from Chattanooga to Knoxville, 189 miles, upon the latter of which the present project of improvement is based.

The obstructions, some twenty-nine in number, were found to consist of gravel bars, reefs of rock, rapids, &c., and the project of improvement contemplates the removal of these obstructions by blasting a channel through the reefs, and building stone wing and retaining dams to scour out the gravel, or deepen the channel by reducing its width so as to secure a depth of 3 feet at low water.

The total amount expended to June 30, 1883, is $215,212.95, which has removed many of these obstructions and greatly improved others, leaving only five or six more to be worked on. The completed work is of a permanent nature, most of the dams being built of heavy stone founded upon solid rock, and the channel excavations showing no signs of filling up.

The appropriation herein estimated for can be profitably expended in continuing the improvement at William's Island Shoals and other obstructions below Knoxville.

July 1, 1882, amount available		$37 70
Amount appropriated by act passed August 2, 1882		7,000 00
		7,037 70
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$6,690 98	
July 1, 1883, outstanding liabilities	59 67	
		6,750 65
July 1, 1883, amount available		287 05
Amount (estimated) required for completion of existing project		9,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		9,500 00

b. Below Chattanooga.—The navigable portion of the Tennessee River, between Chattanooga and its mouth at Paducah, a distance of 453 miles, is divided into two unequal sections by the great Muscle Shoals obstruction between Florence and Decatur, Ala. This obstruction, exclusive of certain portions already navigable, is 23 miles long, and will, when removed, allow free navigation between the Upper Tennessee and its tributaries and the Lower Tennessee and Ohio rivers.

The principal object in view is therefore to remove this great obstruction, and operations have been chiefly directed to that end, giving attention, however, to such minor obstructions as could be removed without serious interference with the main work.

The present project was adopted in 1872 and modified in 1877, and consists in building a canal 70 to 120 feet wide and 6 feet deep around the Big Muscle Shoals, with nine locks, 300 feet between gates and 60 feet wide, to replace the old canal built over fifty years ago, and in extending the improvement in a similar manner around Elk River Shoals, where two locks and 1½ miles of canal are required; Little Muscle Shoals

and certain minor obstructions between Chattanooga and Paducah to be improved by channel excavation, wing-dams, &c.

The total amount expended to June 30, 1883, has been $2,321,850, of which about $2,000,000 has been expended at the Muscle Shoals and the balance at the Suck, Colbert Shoals, and other obstructions, which are either completed or so far improved that nothing further is needed at present.

On the *Elk River Division* the work is well advanced, the heavy channel excavation opposite Gilchrist's Island, which was finished during the year, being about the last of that kind of work required on the shoals. The quarrying and cutting of stone has been continued, and there is now enough on hand to complete one of the locks and one-half of the other. The canal excavation has not been resumed, but it is proposed to put one or more steam excavators at work as soon as funds are available, which would easily complete the canal trunk as soon as the lock-walls could be laid up.

On the *Blue Water* and *Shoal Creek divisions* the nine locks are completed ready for the gates; the masonry of the Shoal Creek aqueduct, 900 feet long, is completed; a permanent bridge has been built across Blue Water Creek, the piers and abutments of which are to be a part of the permanent dam required at this point; and similar work has been done at First Creek and Douglass' Branch. The canal trunk is well advanced and can easily be completed in one year.

The *Little Muscle Shoals* have been put in navigable condition by rock excavation and wing dams, so that nothing further will be required at that point for some time to come. Steamboats drawing 3 feet of water have passed these shoals on low stages of the river. Before improvement a skiff could not have passed under the same conditions.

A small snagging party was employed on the river below Florence for about four months, and removed a large number of overhanging trees and snags that had been very troublesome to steamboats on that part of the river.

The available funds and the appropriations herein estimated for can be profitably expended in continuing operations at Muscle Shoals, and improving navigation at minor obstructions on the river between Chattanooga and Paducah.

July 1, 1882, amount available		$8,852 16
Amount appropriated by act passed August 2, 1882		250,000 00
		258,852 16
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$225,198 07	
July 1, 1883, outstanding liabilities	10,004 09	
		235,202 16
July 1, 1883, amount available		23,650 00
Amount (estimated) required for completion of existing project		1,787,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		700,000 00

(See Appendix Y 1.)

2. *Cumberland River.*—The States of Tennessee and Kentucky, as early as 1830, made appropriations for the survey and improvement of the Cumberland River, and in 1870, 1875, 1879, and 1880, surveys and examinations were authorized by Congress, upon which the present plans of improvement were based.

a. Below Nashville.—The project for the improvement of this section

consists of blasting out a channel through the rock reefs, and removing bowlders, gravel bars, snags, and overhanging trees, to prolong the season of navigation.

During the year work was carried on at Harpeth shoals, Checkered House, and Elk Creek shoals, and at the mouth of the river. The work at Elk Creek Shoals is reported completed, and at the other points above mentioned from one-half to nine-tenths completed, according to existing project.

The entire amount of money expended on this section is $229,731.74. The balance of the funds available, and those herein asked for, can be applied to completing these improvements and others of a similar character between Nashville and the mouth of the Cumberland.

Amount appropriated by act passed August 2, 1882		$15,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$9,545 99	
July 1, 1883, outstanding liabilities	185 75	
		9,731 74
July 1, 1883, amount available		5,268 26
Amount (estimated) required for completion of existing project		13,821 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		13,821 00

b. Above Nashville.—From Nashville to the foot of Smith's Shoals (358 miles).—Work on this section was carried on from September till the close of the fiscal year, excepting when suspended during the winter months on account of high water. Work on this section was carried on at numerous obstructions, building riprap dams and excavating channel. The engineer reports the work completed at five of the obstructions. Operations with a snag-boat were carried on during a part of the low-water season, and a distance of 180 miles of the river was worked over.

The total amount expended between Nashville and the foot of Smith's Shoals is $159,611.77, and has resulted in securing an increased depth of about 10 inches of water at a 2-foot stage for about 220 miles above Nashville, and about 6 inches from that point to Burnside, Ky., on a 3-foot stage. The balance of the funds available and the appropriation herein estimated for can be profitably expended in continuing the improvement of this section under the existing plan.

July 1, 1882, amount available		$3,392 23
Amount appropriated by act passed August 2, 1882		30,000 00
		33,392 23
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$27,806 67	
July 1, 1883, outstanding liabilities	3,197 33	
		31,004 00
July 1, 1883, amount available		2,388 23
Amount (estimated) required for completion of existing project		51,764 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		51,764 00

c. Smith's Shoals (8 miles long).—Work on this obstruction was carried on from September till March, when the work according to the existing project was completed. The work during the year was confined to Long and Mill shoals, and consisted in strengthening and extending the dams originally built, and in excavating through the rock reefs. These shoals, which have a total fall of 55 feet in 8 miles, and which have heretofore formed the most serious obstruction below the Great

Falls, are reported to be in as good condition for navigation as the shoals above; the improvement having increased the depth of water in the channel from 18 to 24 inches on a 50-inch tide. Coal and stone boats drawing from 52 to 54 inches are reported as having passed over these shoals without difficulty between January 21 and April 18. No further work on these shoals is contemplated unless the construction of locks and dams should be authorized by Congress.

The entire amount expended on this section is $114,228.50, with results as above stated.

July 1, 1882, amount available		$254 63
Amount appropriated by act passed August 2, 1882		15,000 00
		15,254 63
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$14,475 83	
July 1, 1883, outstanding liabilities	7 30	
		14,483 13
July 1, 1883, amount available		771 50

d. Above the mouth of Jellico (110 miles).—No work was done on this section during the year. The principal obstructions consist of mill dams, about all of the other work that could be done to advantage for the benefit of the commerce that can pass these dams, having been completed during the previous year. The engineer officer in charge of the work recommended an examination of these mill dams, which was approved by the Chief of Engineers, for the purpose of ascertaining their location, ownership, authority for construction, and estimated value. This examination was made, and the results are given in the report of the engineer, which is appended hereto.

No further appropriation is asked for this section of the Cumberland River.

July 1, 1882, amount available		$1,063 89
Amount appropriated by act passed August 2, 1882		5,000 00
		6,063 89
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$216 67	
July 1, 1883, outstanding liabilities	119 66	
		336 33
July 1, 1883, amount available		5,727 56
Amount (estimated) required for completion of existing project		35,000 00

(See Appendix Y 2.)

3. *Hiwassee River, Tennessee.*—This river is the first important tributary of the Tennessee River above Chattanooga. It rises in the Blue Ridge Mountains, flows northwest and west with a rapid fall to Savannah Ford, and thence for the 33 miles to its mouth is a navigable river. The improvement of this section is based upon the examination made in 1874, the project being to secure a depth of 2 feet for a width of 40 feet from Savannah Ford to its mouth, for which the estimates were $34,000. The total amount expended to June 30, 1883, is $28,868.47. This section has now been worked over, but all of the shoals have not been completed according to the project. To do this would require a further appropriation of $5,000, and it is recommended that the same be made in one appropriation, as the work cannot be economically done with smaller appropriations, and the river is in a condition to wait until a suitable appropriation can be made.

July 1, 1882, amount available		$31 98
Amount appropriated by act passed August 2, 1882		1,500 00
		1,531 98
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$1,382 71	
July 1, 1883, outstanding liabilities	17 74	
		1,400 45
July 1, 1883, amount available		131 53
Amount (estimated) required for completion of existing project		5,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		5,000 00

(See Appendix Y 3.)

4. *French Broad River, Tennessee.*—This river has a course of about 121 miles in Tennessee, of which 90 miles, from Leadvale to its mouth, are susceptible of improvement.

Some forty years ago the State of Tennessee attempted to improve this river, but little good is now manifest from the work then done.

The present project was adopted from an examination made in 1876, and includes the removal of channel obstructions, cutting of overhanging trees, and building wing-dams where necessary, so as to provide 2½ feet of water as high as Leadvale. Above that place slackwater navigation is the only practicable improvement possible, and that would involve enormous cost.

The total amount expended to June 30, 1883, is $18,500, and it has secured the improvement of eleven principal obstructions, giving an additional depth of water of not less than 10 inches.

The appropriation of $15,000 asked for will be applied to the continuation of the present project.

July 1, 1882, amount available		$1,464 59
Amount appropriated by act passed August 2, 1882		5,000 00
		6,464 59
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$6,436 72	
July 1, 1883, outstanding liabilities	27 87	
		6,464 59
Amount (estimated) required for completion of existing project		130,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		15,000 00

(See Appendix Y 4.)

5. *Clinch River, Tennessee.*—This river, after a course of about 100 miles in Virginia, enters Tennessee, and pursuing a south-westerly direction for over 230 miles discharges into the Tennessee River at Kingston.

From 1830 to 1845 the State of Tennessee made appropriations for the improvement of this stream, but without any marked success.

Since the present improvements have been in progress commerce has increased so rapidly as to require nearly double the width of channel thought necessary when the project was adopted.

The plan is based upon the examinations made in 1875 and 1881. It consists of excavating a wide channel through the rock and gravel bars; blasting the bowlders; removing snags and overhanging trees, and building riprap dams where necessary, so as to provide a channel, at ordinary low water, 2 feet deep from Kingston to Clinton and 1½ feet deep from Clinton to Hayne's, or Walker's Ford.

The amount expended to June 30, 1883, is $15,464.90, and has resulted in the permanent improvement of some of the most obstructive and dan-

gerous shoals, so that navigation can now be safely carried on at these places on from 2 to 3 feet lower stages of water than formerly.

River men and other persons interested in the navigation of the Clinch River express satisfaction with the work done and urge the improvement of the remaining shoals as soon as possible.

The appropriation asked for ($10,400) can be profitably expended in improving the remaining shoals according to the present project.

July 1, 1882, amount available		$5,502 00
Amount appropriated by act passed August 2, 1882		3,000 00
		8,502 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$7,369 24	
July 1, 1883, outstanding liabilities	597 66	
		7,966 90
July 1, 1883, amount available		535 10
Amount (estimated) required for completion of existing project		10,400 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		10,400 00

(See Appendix Y 5.)

6. *Duck River, Tennessee.*—This river empties into the Tennessee 14½ miles above Johnsonville. The State of Tennessee never attempted the improvement of this river itself, but incorporated at different times three companies; they all failed to carry out the objects of their charters, and long since abandoned work, without benefiting the navigation of the river.

The present project is based upon an examination made in 1879, and consists in removing snags and overhanging trees, excavating channelways through the rock and gravel bars, and confining the water by brush and riprap dams, so as to afford 2½ to 3½ feet of water in the channel for from four to six months of the year, which is all that is necessary to accommodate the commerce of this river for several years. This project was practically completed by this season's work, and the river is now in good navigable condition from Centreville to its mouth. The improvements may be generally regarded as permanent, although there are a few shoals that may require a little additional work from time to time.

The total amount expended to June 30, 1883, is $12,880.38.

River men report the improvements have afforded the much-needed relief.

The engineer officer in charge recommends that no further appropriation be made at present, unless Congress deems it best to appropriate at least half the amount estimated for ($10,000).

July 1, 1882, amount available		$1,776 25
Amount appropriated by act passed August 2, 1882		3,000 00
		4,776 25
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$4,543 08	
July 1, 1883, outstanding liabilities	113 55	
		4,656 63
July 1, 1883, amount available		119 62
Amount (estimated) required for completion of existing project		22,118 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		10,000 00

(See Appendix Y 6.)

7. *Obey's River, Tennessee.*—This stream enters the Cumberland from the east, at Celina, Tenn., 3 miles south of the Kentucky State line.

In 1879 an examination was made from Barnes's Landing, the head of navigation, to the mouth, about 43 miles, and the plan of improvement is based thereon. It consists in removing the snags, overhanging trees, bowlders, &c., and building wing-dams, so that small steamers, of not more than 3 feet draught, and descending rafts may safely navigate it during high water for four or five months of the year.

Active operations were resumed in June and are now in progress. The total amount expended to June 30, 1883, is $7,842.65, and has secured a gain of about 6 inches of water at the principal shoals, with a tolerably clear channel, and gravel bars and reefs reduced, thus giving all the relief to navigation that is deemed necessary for its limited commerce.

The available funds are deemed sufficient to complete the projected work; no additional plan is submitted, nor appropriation asked for.

Amount appropriated by act passed August 2, 1882		$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$4 20	
July 1, 1883, outstanding liabilities	1,338 45	
		1,342 65
July 1, 1883, amount available		3,657 35

(See Appendix Y 7.)

8. *Caney Fork River, Tennessee.*—This river is a tributary of the Cumberland River, which it enters at Carthage, Tenn. It is navigable for about 80 miles to Sligo's Ford. When examined in 1879 the obstructions were found to be principally gravel-bars, reefs, and a crooked channel. The present plan is to clear and straighten the channel, and build necessary wing-dams, to assist steamboats of not more than 3 feet draught during the usual boating season of about five months.

The amount expended to June 30, 1883, is $10,966.07, and has secured a comparatively safe channel from head of navigation at Sligo's Ford to mouth of the river for steamers of 250 tons at a stage 3 feet above low water. The work done is comparatively permanent, but the stream will require some outlay from year to year to maintain a channel clear of the snags, logs, &c., brought down by heavy floods.

The appropriation herein asked for can be profitably expended in continuing the improvement as projected.

Amount appropriated by act passed August 2, 1882	$4,000 00
July 1, 1883, outstanding liabilities	966 07
July 1, 1883, amount available	3,033 93
Amount (estimated) required for completion of existing project	16,200 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	16,200 00

(See Appendix Y 8.)

9. *Coosa River, Georgia and Alabama.*—This river is formed by the confluence of the Oostenaula and Etowah rivers, near Rome, Ga., and after receiving the Tallapoosa, becomes the main tributary of the Alabama River. Examinations were made in 1870, 1872, and 1875. A plan was adopted in 1875 to provide a channel, not less than 80 feet wide and 3 feet deep at low water, between Rome and Greensport, a distance of 164 miles, and cutting through the Greensport Reefs, to improve the Ten Islands Shoals and Whistenant's Shoals by locks and dams, and extending the improvement to the Selma, Rome and Dalton Railroad Bridge, thus securing open navigation, a distance of about 241 miles from Rome.

The work done during the year mainly consisted of quarrying and cutting stone for locks and dams, laying masonry, building riprap dams, and channel excavation at Lonnergan's and Hart's reefs, extending from 1 to 3 miles, and forming obstructions to the approach to the lower entrance of the canal below the site of Lock 3.

The amount expended to June 30, 1883, is $320,683, and has resulted in securing a fair, navigable channel, having an increased depth of about 8 inches at low water from Rome to Greensport; a navigable channel cut through the Greensport Reefs, and work on the Ten Islands Shoals Canal well advanced. The masonry of two locks is finished, and stone cut ready for the third lock; of the longitudinal dams at Lock No. 2, one is completed and the other nearly so.

The appropriation herein asked for can be profitably expended in building Lock No. 3, putting in lock-gates, and in further improving the channel of the river above and below the canal.

July 1, 1882, amount available		$17,857 21
Amount appropriated by act passed August 2, 1882		83,700 00
		101,557 21
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$49,698 44	
July 1, 1883, outstanding liabilities	3,841 77	
		53,540 21
July 1, 1883, amount available		48,017 00
Amount (estimated) required for completion of existing project		183,647 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		150,000 00

(See Appendix Y 9.)

10. *Oostenaula and Coosawattee rivers, Georgia.*—These rivers are tributary to the Coosa River. Examinations were made in 1872 and 1874, and the improvements based thereon are practically finished, according to the project. The amount expended to June 30, 1883, is $24,858.14, which has resulted in removing the channel obstructions in each river, and in reducing the rock and gravel bars. Good channels are obtained for nine months in the year in the Oostenaula with a depth of 3 feet, and in the Coosawattee with 2 feet of water—about all that can be done without slackwater navigation. The available funds will be expended near the mouth of the Oostenaula. No work has been done nor funds expended during the fiscal year. No commercial necessity exists for any further appropriations for these rivers.

July 1, 1882, amount available	$141 86
Amount appropriated by act passed August 2, 1882	1,000 00
	1,141 86
July 1, 1883, amount available	1,141 86

(See Appendix Y 10.)

11. *Ocmulgee River, Georgia.*—The Ocmulgee and Oconee rivers form the Altamaha, which is the highway for the vast trade in lumber, cotton, and naval stores reaching the Atlantic coast at Darien, Ga.

The State of Georgia in the early part of this century made several appropriations for improving this river.

The present plan of improvement is based upon the examination made by the United States in 1875, when the obstructions were found to be snags, sand and gravel bars, rock reefs, overhanging trees, and submerged rafts, in a shifting and tortuous channel.

The amount expended to June 30, 1883, is $52,840.81, which has

resulted in securing a tolerably straight, clear, and useful channel, having about 3½ feet at low water between Hawkinsville and the mouth of the river, while several of the most serious obstructions, as that at Dick Swift Cut, and the log jam near Barrow's Bluff, have ceased to exist.

The nature of the river and work is such that a small force will necessarily be required from time to time to remove recently-formed obstructions.

The appropriation asked for ($10,000) can be expended in clearing the channel by use of snag-boats, and in building necessary cribs and booms to assist rafts.

July 1, 1882, amount available		$200 51
Amount appropriated by act passed August 2, 1882		5,000 00
		5,200 51
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$4,037 84	
July 1, 1883, outstanding liabilities	3 48	
		4,041 32
July 1, 1883, amount available		1,159 19
Amount (estimated) required for completion of existing project		27,240 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		10,000 00

(See Appendix Y 11.)

12. *Oconee River, Georgia.*—This river, with the Ocmulgee, forms the Altamaha, which is the outlet of the lumber and naval stores of Central and Southeastern Georgia for shipment to foreign and domestic ports. The State of Georgia made several appropriations early in the present century for improving the Oconee. The first examination made by the United States was in 1874. The obstructions were then found to be snags, overhanging trees, sunken logs, and consequent bars, reefs, &c.

The total amount expended to June 30, 1883, is $18,271.19, which has resulted in greatly improving navigation, securing a comparatively clear channel from Dublin to the mouth of the river, having an increased depth closely approximating to 3 feet at low water, the projected depth to the Georgia Central Railroad Bridge.

The reduction of the rock reefs extending across the river at Carr's Shoals is now progressing satisfactorily.

The available funds and the appropriation herein asked for can be profitably expended in finishing work at Carr's Shoals, and in maintaining a clear channel from the Georgia Central Railroad Bridge to mouth of the river.

July 1, 1882, amount available		$37 85
Amount appropriated by act passed August 2, 1882		5,000 00
		5,037 85
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$2,088 31	
July 1, 1883, outstanding liabilities	720 73	
		2,809 04
July 1, 1883, amount available		2,228 81
Amount (estimated) required for completion of existing project		29,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		10,000 00

(See Appendix Y 12.)

13. *Red River, Tennessee.*—This river enters the Cumberland near Clarksville. An examination was made from its mouth to Port Royal, about 38 miles. The present plan is to remove the channel obstructions

and build wing-dams where necessary. No work was done during the fiscal year. The total amount expended to June 30, 1883, is $4,956.43, which has resulted in a comparatively clear channel, having an increased depth of 4 inches of water at the improved shoals. Light-draught steamboats of 15 inches draught can go to Port Royal during four months of the year. Commerce limited. Several bridges are serious obstructions. The appropriation estimated for can be applied to continuing work under the present plan.

July 1, 1882, amount available	$43 57
July 1, 1883, amount available	43 57
Amount (estimated) required for completion of existing project	5,103 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	5,100 00

(See Appendix Y 13.)

14. *Little Tennessee River, Tennessee.*—This river rises in the Blue Ridge, flows northwesterly, and empties into the Tennessee near Lenoir's.

In 1874 this river was examined from its mouth to the Chilhowee Mountains (25 miles); in 1875 from mouth of Citico Creek to Rabun's Gap, Ga. (109 miles); and in 1882 from its mouth to the mouth of the Tellico River, about 13 miles.

The plan of improvement covers only this last section, and consists in removing snags, reefs, bowlders, &c., from the channel, cutting overhanging trees, and building wing-dams, so as to provide a channel 40 feet wide and 2 feet deep during low water to the mouth of the Tellico River.

The unusual high water that has prevailed since this work was started has greatly retarded its progress. As soon as the water permits, the work will be pushed rapidly forward.

The total amount expended to June 30, 1883, is $2,200.54.

The unexpended balance ($2,800) and the additional appropriation of $10,000 can be profitably expended in carrying forward this work according to the present project.

Amount appropriated by act passed August 2, 1882		$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$1,712 95	
July 1, 1883, outstanding liabilities	487 59	
		2,200 54
July 1, 1883, amount available		2,799 46
Amount (estimated) required for completion of existing project		18,724 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		10,000 00

(See Appendix Y 14.)

15. *South Fork of Cumberland River, Kentucky.*—The South Fork of the Cumberland River is formed by the union of Clear Fork and New River, about 8 miles below the crossing of the latter stream by the Cincinnati Southern Railway. It flows north and enters the Cumberland River at Burnside, Ky. As far as the "Devil's Jumps" (9 miles north of Kentucky State line) it flows through a narrow cañon, obstructed with immense bowlders containing from 400 to 8,000 cubic yards each. This section could not be rendered navigable except at enormous cost. From here to the mouth (44 miles) the sandstone bluffs gradually recede, and the fall becomes much less rapid, and the obstructions are of the nature of those in other mountain streams in this locality, but of greater extent.

The plan of improvement is based upon the examination made in 1881, and provides for the removal of the most dangerous obstructions and

the building of wing-dams to confine the water to the channel, so that descending navigation can be safe when there is a rise of at least 3 feet above low water.

The total amount expended is $1,696.32 and has been applied in fitting up the necessary boats, &c., and in the partial improvement of Sloan's Shoals.

The balance on hand and the additional appropriation asked for can be applied to executing the project from the mouth of the river to the Kentucky State line.

Amount appropriated by act passed August 2, 1882		$3,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$1,636 32	
July 1, 1883, outstanding liabilities	60 00	
		1,696 32
July 1, 1883, amount available		1,303 68
Amount (estimated) required for completion of existing project		59,803 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		10,000 00

(See Appendix Y 15.)

IMPROVEMENT OF THE OHIO RIVER AND OF THE FALLS OF THE OHIO; OPERATING AND MAINTAINING THE LOUISVILLE AND PORTLAND CANAL; IMPROVEMENT OF THE MONONGAHELA RIVER, WEST VIRGINIA AND PENNSYLVANIA, AND OF ALLEGHENY RIVER, PENNSYLVANIA; CONSTRUCTION OF ICE HARBOR AT MOUTH OF THE MUSKINGUM RIVER, OHIO, AND OF A HARBOR OF REFUGE NEAR CINCINNATI, OHIO.

Officer in charge, Lieut. Col. William E. Merrill, Corps of Engineers, having under his immediate orders Capt. Frederick A. Mahan, Corps of Engineers.

(The improvement of the Falls of the Ohio and the operation and maintenance of the Louisville and Portland Canal were under the charge of Lieut. Col. Godfrey Weitzel, Corps of Engineers, to July 31, 1882, and of Maj. F. U. Farquhar, Corps of Engineers, from July 31 to September 18, 1882.)

1. *Ohio River, Davis Island Movable Dam.*—During the fiscal year Weirs 1, 2, and 3 of this dam were completed, including the erection of a service bridge, from which the wickets of these weirs are to be handled. These weirs, which are of the same general construction as the Navigable Pass of the dam, except that their sills are 1, 2, and 3 feet higher, respectively, extend from the Navigable Pass to Davis Island. Weir 1 is 224 feet long, and contains fifty-six wickets; Weir 2 is 224 feet long, and contains fifty-six wickets; Weir 3 is 216 feet long, and has fifty-four wickets. The construction of the fixed dam to close the channel behind Davis Island is also well advanced.

To finish this work it will be necessary—

1. To complete the fixed dam behind Davis Island, including the protection of the banks at each end.

2. To complete the service bridge of the weirs, including piers and pier platforms.

3. To complete the earth filling about the abutment of the movable dam.

4. To finish the coping of the lock.

5. To build a small movable dam at the head of the lock.

6. To build the lock-gates and to provide the necessary operating machinery, including pumps, piping, and tanks.

Brown's Island Dam.—This dam was completed, with the exception of a small portion of the paving. It was somewhat damaged by ice during the last winter, but it will be repaired and completed during the first low water.

Twelve Pole Dike.—This dike has been built to its full length of 2,450 feet. About 200 feet of the lower end of the dike is not fully ballasted, and the paving of the top surface is not yet completed. It will be finished during the present season.

Portland Dike.—This dike is built to its full length of 2,581 feet. Like the Twelve Pole Dike it requires some additional ballasting at the lower end, and about two-fifths of the paving of the top surface is yet to be completed. It will be finished during the present season.

Puppy Creek Dike.—The substructure of this work is complete for its full length of 2,850 feet, and the superstructure of squared timber and stone, 4 feet in height, is built to a length of 2,000 feet. The dike will be completed during the present low-water season.

Grand Chain, Upper Dike.—This dike is now 2,100 feet long, having been extended 400 feet in 1882. It is to have a total length of 3,000 feet, and as the stone needed for its completion is all quarried and delivered near the work it is expected that the dike will be rapidly finished as soon as the stage of the river will permit.

Grand Chain, Lower Dike.—This work has been built to its full length of 3,130 feet, and the substructure is entirely finished; 530 feet of the superstructure is yet to be built.

On account of the unfavorable stage of the river no work could be done on the Grand Chain Dikes until the latter part of September, 1882, and although great effort was made to complete them last year the season proved too short for the purpose.

Dredging.—The dredges Ohio and Oswego were employed during 1882 in excavating at the foot of Pike Island, at Upper and Lower Twin islands, at Wheeling Creek Bar, at Fish Creek Island, at Newell's Run Bar, at Second Brother Island, at Rowland's Race, at Little Muskingum Bar, and at Marietta. A total of 110,774 cubic yards of excavation was made during the season by the dredges, and four wrecks and nine snags were removed from the channel.

The average cost per cubic yard for dredging was 14 cents.

The new iron hull for the dredge Oswego has been completed. The machinery of the old dredge will be transferred to this new hull as soon as funds for this purpose are available.

Snagging.—The snag-boat E. A. Woodruff began work on August 7, having been delayed since June 20 by the explosion of her auxiliary boiler, and went into winter quarters on December 8. During the season nine hundred and ninety-six snags were removed, forty wrecks were either wholly or partially broken up, the remains of seven wrecks previously partially destroyed were wholly removed.

Removal of rocks.—As the river remained unusually high during the season, but little opportunity was offered for removing rocks from the shallow bars. One party was, however, employed from October 19 to November 18 in removing rocks from the tow-boat channel to the left of Mustapha Island. Estimated weight of rock removed, 817 tons.

Falls of the Ohio.—On account of the unusually high stage which prevailed during the season it was impracticable to make any progress on the improvement of the Indiana or Main Chute. Effort was made to put in place one of the two sections of movable dam designed to

narrow the opening at the head of this chute, but the unexpected coming of high water made it impracticable. All the iron work is on hand and ready to go in as soon as the river will permit.

In order to lessen the rapidity of the current through the Indiana Chute it has been decided to widen the pass at the head of the Middle Chute from 300 to 500 feet, and an additional section of Boulé Dam, 200 feet in length, has been constructed for this purpose, and is ready to be put in place at the first low water.

Timber has also been purchased for the construction of guiding-dikes to aid in the passage of the Indiana and Middle chutes.

The original condition of the Ohio River as to depth, width, and navigability cannot be stated in definite figures, as there is no defined plane from which to measure, both the low-water line and the elevation of the river bed being variable. There has undoubtedly been a general improvement in navigability, but the amount of this improvement can not be expressed in figures.

The general method of improvement has been to remove snags and rocks, to close up duplicate channels by low dams, to hold up and guide the water by dikes where the river is too wide, and to remove hard bars and projecting points. The radical improvement of the river so as to secure a minimum depth of 6 feet in low water has been begun by the coustruction of the Davis Island Dam, but this work has not yet been completed.

The amount appropriated for the improvement of the Ohio River from the first appropriation in 1827 to June 30, 1883, is $3,170,479.25. In addition to this there has been allotted to this river a portion of twenty-three different combined appropriations for the Ohio, Mississippi, Missouri, and Arkansas rivers which aggregate $1,947,000, but the amount thus allotted is unknown.

The amount that can profitably be expended during the next fiscal year is $1,000,000. With this sum the Davis Island Dam can be completed, and navigation be materially improved at the places named in the report.

The officer in charge submits the following estimate for the ensuing year:

Davis Island Dam, completion	$70,000 00
Falls of the Ohio	50,000 00
Dams and dikes	868,250 00
Snagging	25,000 00
Dredging	16,500 00
Completion of new iron dredge	4,000 00
Removing rocks	5,000 00
Office expenses, inspection, engineering, and contingencies	25,000 00
	1,063,750 00

July 1, 1882, amount available		158,575 44
Amount appropriated by act passed August 2, 1882		350,000 00
		508,575 44
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$362,913 69	
July 1, 1883, outstanding liabilities	34,448 38	
		397,362 07
July 1, 1883, amount available		111,213 37
Amount that can be profitably expended in fiscal year ending June 30, 1885		1,000,000 00

(See Appendix Z 1.)

2. *Operating and maintaining the Louisville and Portland Canal.*—During the year the canal was in operation for three hundred and four days; it was closed for fifty-seven days on account of high water, and for four days by ice. Four thousand nine hundred and fifty-four vessels, representing an undertonnage of 1,226,455 tons, passed through the canal during the year.

The total expenditures for the year ending June 30, 1883, were $61,333.14, of which sum $4,008.91 was for repairing damages caused by the great flood of February, 1883, and $2,692.18 was for permanent improvements.

The estimated amount required for operating and maintaining the canal during 1883–'84 is $77,740, and during 1884–'85, $128,540.

The officer in charge calls attention to the recommendations of his predecessor, Lieutenant-Colonel Weitzel, for a high-water lock and an enlargement of the upper entrance to the canal, and strongly indorses them as being of great public necessity. For local reasons he recommends that the project for the enlargement of the upper entrance of the canal be modified as explained in a special report.

(See Appendix Z 2.)

3. *Improvement of Monongahela River, West Virginia and Pennsylvania.*—Under the appropriation of August 2, 1882, the construction of Lock No. 8, at the mouth of Dunkard Creek, was begun on September 2, and operations were closed for the season on November 30. A cofferdam, 122 feet long and 115 feet wide, was built to inclose the upper end of the lock; and, at the close of the season, the foundations of both walls of the lock for a length of 23 feet, the whole of the cross-wall at the head of the lock, and 32 feet of the wing-wall had been built to a height of 3 feet above low water. Total amount of masonry laid, 810 cubic yards.

The contractors for furnishing stone for this lock have delivered 6,136 cubic yards of the 10,325 cubic yards called for by their contract.

No further work of construction will be attempted the present year, as the funds on hand will all be required to pay for the remaining stone to be furnished under the existing contract.

Before work was begun on the Upper Monongahela it was unnavigable except in freshets.

The originally adopted project contemplated the construction of three locks and dams, so as to extend the existing slackwater from New Geneva to Morgantown. Of these, No. 7 was to be built by the Monongahela Navigation Company, and Nos. 8 and 9 by the United States.

The amount thus far appropriated toward carrying out this project is $262,000, of which sum $238,700.65 had been expended up to June 30, 1883. The result attained is the construction of one masonry lock and dam and the commencement of another. The finished dam gives at least 6 feet of water throughout its pool during all stages.

The amount that can be profitably expended during the year ending June 30, 1885, is $93,000, of which $4,000 is for current expenses at No. 9 during 1883–'84 (for which no appropriation was made), and during 1884–'85, and the remainder is for completing lock and dam No. 8. The amount of progress which will be made is so contingent on the season that it cannot be predicted with any certainty. It is estimated that the sum asked for will complete the entire project. After completion, annual appropriations will be required for operating and maintaining the works.

Amount (estimated) for completion of existing project	$164,000 00
Already appropriated	75,000 00
Amount still required	89,000 00
Amount needed for running expenses and contingencies of Lock No. 9 for two years ending June 30, 1885	4,000 00
Total	93,000 00

July 1, 1882, amount available		37,968 97
Amount appropriated by act passed August 2, 1882		25,000 00
		62,968 97
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$34,679 22	
July 1, 1883, outstanding liabilities	4,990 40	
		39,669 62
July 1, 1883, amount available		23,299 35

Amount (estimated) required for completion of existing project	89,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885, including operating expenses of lock	93,000 00

(See Appendix Z 3.)

4. *Allegheny River, Pennsylvania.*—The work on this river has been principally confined to the removal of rocks and snags from the channel. Seven parties were employed on this work during the season of extreme low water, the net results being the removal of 301 snags and 28,513 cubic yards of rock obstructions between the mouth of French Creek and the city of Pittsburgh.

Some additional stone was also placed upon the dams at Six Mile and Nicholson islands to arrest the scour below, which threatened to undermine these works.

This work has given great satisfaction to the river interests, by prolonging the period of low-water navigation and rendering the passage of the river much less hazardous at all stages.

The officer in charge renews his recommendation for the construction of a lock and dam at Garrison Ripple, in Pittsburgh Harbor, at an estimated cost of $153,000, and asks for an additional appropriation of $100,000 for continuing the removal of rocks.

No work will be attempted during the current fiscal year for lack of available funds.

Total amount appropriated for improvement of the Allegheny River	$70,000 00
Amount expended to June 30, 1883, in the removal of rocks and construction of dams at Six-Mile Island and Nicholson Island	69,183 31

July 1, 1882, amount available		$1,899 28
Amount appropriated by act passed August 2, 1882		15,000 00
		16,899 28
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		16,082 59
July 1, 1883, amount available		816 69
Amount that can be profitably expended in fiscal year ending June 30, 1885		100,000 00

(See Appendix Z 4.)

5. *Ice harbor at mouth of Muskingum River, Ohio.*—Owing to the lateness of the season when it was practicable to begin operations, and to delay caused by subsequent high water, work on the lock at Marietta was limited to prolonging the outer wall of the lock, a distance of 68 feet,

to the upper face of the State dam, to getting in an additional portion of the lock floor, and to making and hanging the upper lock gates. The entire quantity of stone required for completing the lock has been delivered at the work.

The officer in charge submits the following estimate for the ensuing year:

Original estimated cost of lock		$216,000 00
Increase of estimate due to delays in work and unexpected difficulties of construction		30,000 00
		246,000 00
Amount already appropriated		150,000 00
Required to complete lock		96,400 00
July 1, 1882, amount available		7,254 62
Amount appropriated by act passed August 2, 1882		40,000 00
		47,254 62
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$38,653 97	
July 1, 1883, outstanding liabilities	683 69	
		39,337 66
July 1, 1883, amount available		7,916 96
Amount (estimated) required for completion of existing project		96,400 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		96,400 00

(See Appendix Z 5.)

6. *Harbor of Refuge near Cincinnati.*—No work has been done during the past year, and none is contemplated during the present year. The project to build a third dike at Four-Mile Bar in order to assist the present dikes in their work of holding back ice floes from the harbor of Cincinnati, and also to improve the navigation of the Ohio River at this point, has been approved by Congress by the appropriation in 1882 of half of the required sum. It is not deemed advisable, however, to begin the construction of this dike until the full amount estimated for its completion ($33,000) is on hand and available for the work. This will necessitate a further appropriation of $17,000.

Amount appropriated by act passed August 2, 1882	$16,000 00
July 1, 1883, amount available	16,000 00
Amount (estimated) required for completion of existing project	17,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	17,000 00

(See Appendix Z 6.)

IMPROVEMENT OF KENTUCKY AND TRADEWATER RIVERS; OF BIG SANDY RIVER, KENTUCKY AND WEST VIRGINIA, AND OF GUYANDOTTE AND LITTLE KANAWHA RIVERS, WEST VIRGINIA.

Officers in charge, Maj. J. W. Cuyler, Corps of Engineers, until his death, April 16, 1883, since which time Capt. J. C. Post, Corps of Engineers.

1. *Kentucky River, Kentucky.*—The present plan of improvement adopted contemplates a slack-water system of navigation on this river from its mouth to the junction of the Three Forks, at Beattyville, a distance of 252 miles. This required the repair of five locks and dams constructed by the State of Kentucky and the construction of twelve new locks and dams.

The operations of the past year have been confined to the repairs of these locks and dams, and maintaining navigation by means of them for a distance of 82 miles, or 17 miles above the city of Frankfort. This has been practically continuous, with the exception of the interruption caused by freshets. The navigation of this river is much restricted by the bridges spanning it. These are without draws, and a slight rise prevents the passage of the steamers.

Of the $225,000 appropriated by act of Congress August 2, 1882, $75,000 was designated for the construction of a lock and movable dam at Beattyville, Ky. As no provision was made by Congress for acquiring the land necessary for the site of this work, nothing beyond a survey for its location has been done.

During the present fiscal year it is proposed to continue the repairs to the four locks and dams now in operation and maintain navigation by their aid so far as it is affected by them. Without an additional appropriation this navigation cannot be continued beyond the end of the present fiscal year. It is also proposed, during the present year, should Congress make a sufficient appropriation, to repair lock and dam No. 5, and construct lock and dam No. 6, and the lock and dam at Beattyville.

There has been appropriated to date $550,000; of this sum there had been expended to June 30, 1883, $442,227.97. It will be perceived that the estimate for completion as given below has been considerably increased. For an explanation of this increase see Appendix A A 1 of this report.

July 1, 1882, amount available		$1 24
Amount appropriated by act passed August 2, 1882		225,000 00
		225,001 24
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$116,191 51	
July 1, 1883, outstanding liabilities	1,037 70	
		117,229 21
July 1, 1883, amount available		107,772 03
Amount (estimated) required for completion of existing project		2,471,639 26
Amount that can be profitably expended in fiscal year ending June 30, 1885		380,000 00

(See Appendix A A 1.)

2. *Big Sandy River, West Virginia and Kentucky.*—The project for improving the natural channels of this river and its tributaries by the removal of snags, overhanging trees and bowlders, and the concentration of the water by wing-dams, was adopted in 1878. This has been continued, and a clear channel formed 50 feet wide and 2 feet deep at ordinary low water from Louisa, Ky., to 100 miles above on the Louisa Fork, or 15 miles above Piketon, Ky., the head of steamboat navigation. A channel of the same dimensions has also been formed from Louisa up the Tug Fork 108 miles. This latter includes the "Rough of Tug," and extends 6 miles above it.

No work has been done upon the project for the slackwater improvement upon the lower river. Bids were invited September 25, 1882, for supplying the stone for the lock to be constructed near Louisa, but those received exceeded the original estimate so much that they were rejected. New bids were received June 20, 1883, and the work has been awarded to the lowest bidder. No contract had been made at the end of the fiscal year.

During the next fiscal year it is proposed, with the balance remaining on hand for the improvement of the Louisa Fork, to remove such ob-

structions as the recent freshets have brought into the channel. A contract for the delivery of the stone for the lock will also be made and the work of construction commenced.

Total amount appropriated to date		$154,000 00
Total expenditures to June 30, 1883		52,435 28
July 1, 1882, amount available		89,204 12
Amount appropriated by act passed August 2, 1882		25,000 00
		114,204 12
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$12,538 90	
July 1, 1883, outstanding liabilities	100 50	
		12,639 40
July 1, 1883, amount available		101,564 72
Amount (estimated) required for completion of existing project		112,645 31
Amount that can be profitably expended in fiscal year ending June 30, 1885.		80,000 00

(See Appendix A A 2.)

3. *Guyandotte River, West Virginia.*—The project for the improvement of this river was adopted in 1878, and operations have been conducted in conformity with it. This consisted in removing obstructions, both natural and artificial, and opening a clear channel 30 feet wide and 18 inches deep at the lowest stages of water.

During the past fiscal year the improvement was extended up the river 12 miles, making the whole distance improved 110 miles, greatly aiding navigation. It is proposed, during the present year, to make additional improvements now needed between Logan Court-House and the mouth.

Total amount appropriated to date		$10,500 00
Total expenditures up to June 30, 1883		9,271 02
July 1, 1881, amount available		846 36
Amount appropriated by act passed August 2, 1882		2,000 00
		2,846 36
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		1,427 48
July 1, 1883, amount available		1,418 88
Amount that can be profitably expended in fiscal year ending June 30, 1885.		5,000 00

(See Appendix A A 3.)

4. *Little Kanawha River, West Virginia.*—The present project adopted in 1880 proposes, by the construction of an additional lock and dam, to extend the slack water navigation a distance of 12 miles up the river.

No other operations than receiving the stone contracted for and preparing it for laying have been carried on during the past fiscal year.

Nine hundred and sixty-eight and three-tenths cubic yards dimension stone, and 534.7 cubic yards of rubble have been received.

It is proposed during the present year to complete the contract for receiving the stone and finish cutting it. If an additional appropriation is made, or the $31,000 appropriated by act of August 2, 1882, is made available, the work of constructing the lock and dam will be commenced.

The act of August 2, 1882, imposed the condition that the Little Kanawha Improvement Company should enter into an agreement not to charge in any manner any tolls on this river before the money appro-

priated by it was to be available. This has not been done, and there seems little or no probability that it will be. Additional action of Congress is therefore necessary before this appropriation can be used.

Total amount appropriated for the improvement of this river to date		$129,300 00
Total expended		67,032 30
July 1, 1882, amount available		48,663 58
Amount appropriated by act passed August 2, 1882		31,000 00
		79,663 58
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$15,495 92	
July 1, 1883, outstanding liabilities	1,899 96	
		17,395 88
July 1, 1883, amount available		62,267 70
Amount (estimated) required for completion of existing project		49,673 02
Amount that can be profitably expended in fiscal year ending June 30, 1885		50,000 00

(See Appendix A A 4.)

5. *Tradewater River, Kentucky.*—The present project for improving this river was submitted January 21, 1881. This has been commenced and extended 7 miles, and navigation greatly improved.

No work was done during the last fiscal year, owing to the season being so far advanced before the appropriation was available, and the additional delay which would have been necessary before a working party could commence operations.

It is proposed during this fiscal year to increase the dimensions of the channel through the rock bar near the mouth of the river and extend the improvement up-stream as far as possible. The additional amount asked for will be applied in the same manner.

Total amount appropriated	$6,500 00
Total amount expended to June 30, 1883	2,997 08
July 1, 1882, amount available	2 92
Amount appropriated by act passed August 2, 1882	3,500 00
July 1, 1883, amout available	3,502 92
Amount (estimated) required for completion of existing project	10,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	5,000 00

(See Appendix A A 5.)

IMPROVEMENT OF WABASH RIVER, INDIANA AND ILLINOIS, AND OF WHITE RIVER, INDIANA.

Officer in charge, Maj. Jared A. Smith, Corps of Engineers.

1. *Wabash River, Indiana and Illinois.—a. Below Vincennes.*—At the beginning of the fiscal year all active work had been suspended for want of funds. Work was resumed August 26 and continued until November 21, since which time ice and high water have prevented further operations.

The improvement at Little Chain has been pushed forward as far as circumstances permitted, but as boats cannot pass through the new channel until its entire length has been cut, no benefit has yet been derived.

In order to complete the work as early as possible a new dredge has

been constructed and will be ready to work as soon as the high stage of water subsides.

Repairs more or less extensive have been made to the dams in Little Chain Cut-off, Turkey Island Chute, and New Harmony Cut-off, and the dike at Grand Chain, maintaining these works in good condition.

The improvements thus far have been of much benefit to the navigation, and have incidentally encouraged many business interests. It is believed by the officer in charge that the benefits have far outweighed the expense.

The amount expended to June 30, 1883, has been $373,016.40.

It is proposed to expend the present balance of appropriation in continuing the improvement at Little Chain and caring for public property, until a further appropriation shall have been made.

The principal points requiring further improvement, besides removing snags and making various small wing-dams and bank protections, are Widow Goss Bar, Skidmore Bar, Little Chain, Grand Chain, Wanick's Ripple, and the lock and dam at Grand Rapids.

The latter work is of great importance, and a separate appropriation of $65,000, one-half its estimated cost, is recommended for the year ending June 30, 1885.

For the other works an appropriation of $50,000 is asked, making a total of $115,000, which is not too much to expend judiciously in a single year.

July 1, 1882, amount available		$444 11
Amount appropriated by act passed August 2, 1882		40,000 00
		40,444 11
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$21,691 04	
July 1, 1883, outstanding liabilities	659 14	
		22,350 18
July 1, 1883, amount available		18,093 93
Amount that can be profitably expended in fiscal year ending June 30, 1885		115,000 00

b. Between Vincennes and Lafayette.—The modifications to steamer and construction of a pile-driver were completed September 21. Operations were continued until November 20, when cold weather compelled a suspension of work. Since the winter months high water has prevented any progress, so that work was only practicable during a period of less than two months.

A substantial dam 270 feet long has been constructed across one of the channels at Eight-Mile Island, and the banks protected on each side.

The survey of the river has been extended about 47 miles, and the maps finished.

No work has been done above the highway bridge at Terre Haute, for the reason that numerous railroad and highway bridges have been built without draws, and several with draws badly arranged and located, so that any considerable navigation is impossible so long as they remain in their present condition.

The Department of Justice having decided that these obstructions can only be removed or modified by act of Congress, a consideration of the subject by Congress is desirable. It will be useless to attempt any improvements above Terre Haute until the bridges are modified.

Improvements between Vincennes and Terre Haute have been such that small steamers can now run the entire distance at the lowest stages of water, no such navigation being possible three years ago.

The total amount expended to June 30, 1883, has been $41,179.54.

It is proposed to continue the survey and the removal of snags as far as possible with the funds now available.

A dam is required across the cut-off at Horseshoe Bend, the banks require protection in various places, and several wing-dams are needed to confine the channel. Many snags yet remain which should be removed.

For continuing the work as indicated an appropriation of $50,000 is recommended.

July 1, 1882, amount available		$4,023 30
Amount appropriated by act passed August 2, 1882		30,000 00
		34,023 30
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$19,058 07	
July 1, 1883, outstanding liabilities	1,144 77	
		20,202 84
July 1, 1883, amount available		13,820 46
Amount that can be profitably expended in fiscal year ending June 30, 1885.		50,000 00

(See Appendix B B 1.)

2. *White River, Indiana.*—The work of improvement has been of a kind which could not be satisfactorily carried on by contract, and it has, therefore, been done by hired labor and open purchases of material.

The improvement at Kelly's Ripple was resumed in July and continued until November 18.

The timber dike was extended 420 feet, and 2,483 cubic yards of rock were removed from the channel.

All the drilling and removal of stone has been done by men standing in the water, as a coffer dam would be too expensive, and it was hoped to avoid the expense of a dredge. It became evident that a dredge must be procured in order to complete the channel in a reasonable length of time. Machinery has therefore been purchased and a dredge completed by securing it on board a barge. One-half the cost of the dredge is borne by the Wabash River improvements, where it will be also used.

The snag-boat and crew were employed from August 21 to November 18.

The work has been confined to 17 miles of the river between Hazelton and its mouth.

The improvements thus far have greatly benefited the channel, but other work must be completed, especially at Kelly's Ripple, before the full benefit can be realized.

Small steamers can now navigate the river for a distance of 40 miles from its mouth at stages during which it has never before been possible.

The bridge at Hazelton is a great obstruction, and the railroad company should provide a good draw. No further work should be done above the bridge until the construction of a draw is accomplished.

It is proposed to expend the available balance of funds, and the appropriation herein asked for, in completing the channel at Kelly's Ripple and constructing wing-dams for the removal of 2 bars below Hazelton.

The amount expended on the improvement of this river has been $78,469.81. The original estimate was $150,000 to make the river fairly navigable for a distance of 74 miles to steamers drawing 2 feet of water. The amount estimated to complete the work is $45,000.

An appropriation of $25,000 is recommended to complete the work below Hazelton.

July 1, 1882, amount available		$8,298 67
Amount appropriated by act passed August 2, 1882		20,000 00
		28,298 67
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$20,583 29	
July 1, 1883, outstanding liabilities	1,185 19	
		21,768 48
July 1, 1883, amount available		6,530 19
Amount (estimated) required for completion of existing project		45,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		25,000 00

(See Appendix B B 2.)

BRIDGING NAVIGABLE WATERS OF THE UNITED STATES.

1. *Bridging Great Kanawha River, West Virginia.*—In reply to the reference to this office of Senate resolution of February 13, 1883, directing the Secretary of War to transmit to the Senate any information on file in his Department which would assist in showing what would be the minimum number, widths, and height of spans, and their character, in railroad and other bridges that may be authorized across Great Kanawha River, reports were transmitted which had been received from Lieut. Col. William P. Craighill, Corps of Engineers, and his assistant, Lieut. Thomas Turtle, Corps of Engineers, July, 1880, with reference to a proposed bridge at Charleston, West Virginia, as containing all the information upon this subject in the possession of this office. This communication was printed as Senate Ex. Doc. No. 73, Forty-seventh Congress, second session, and will also be found in Appendix C C 1 of this report.

2. *Pile and ponton bridge across the Mississippi River at Dubuque, Iowa.*—The Secretary of War having decided that he was without authority to sanction a change in the widths of the draw which was deemed essential to the interests of navigation, an amendment to the act of March 3, 1875, authorizing the construction of this bridge, was proposed to meet the case in Senate bill No. 2358, but failed to receive action by the last Congress.

For the correspondence on this subject see Appendix C C 2.

3. *Bridge of the Sioux City and Pacific Railroad Company proposed to be built across Missouri River under authority of the act of July 27, 1882.*—The plans of this bridge were approved by the Secretary of War July 29, 1882.

(See Appendix C C 3.)

4. *Bridges at Camden and near Pine Bluff, Arkansas.*—For the action of this office upon the subject of the bridges of the Texas and Saint Louis Railway Company, proposed to be built under authority of the act of June 27, 1882, over Ouachita River at Camden, Arkansas, and over Arkansas River, near Pine Bluff, Arkansas, see Appendix C C 4.

5. *Bridging Lake Champlain at Rouse's Point, New York, and Alburg, Vermont.*—The plan and location of this bridge were approved by the Secretary of War February 24, 1883, under authority of the act of February 22, 1883.

(See Appendix C C 5.)

LAKE HARBORS AND RIVERS.

IMPROVEMENT OF THE HARBOR AT DULUTH, MINNESOTA, AND OF THE ENTRANCE TO SUPERIOR BAY, LAKE SUPERIOR—IMPROVEMENT OF THE HARBOR OF GRAND MARAIS, MINNESOTA.

Officer in charge, Maj. C. J. Allen, Corps of Engineers.

1. *Harbor at Duluth, Minnesota.*—The present plan of improvement as to dredging is based upon the report and estimates of a Board of Engineers convened in January, 1881, which contemplated the maintenance of the dredged areas and enlargement of the harbor by dredging as follows, viz:

1. On a line from Rice's to Minnesota Point.
2. On a line from the Blast Furnace Docks to intersect with the channel of the Saint Louis River.
3. On a line parallel to Minnesota Point; and,
4. Along the west side of Rice's Point in Saint Louis Bay.

The dredging to provide for a depth of 16 feet at low water.

The cost of the plan, including the item of $25,000 for maintenance of the canal piers, was placed at $212,988.36.

For original projects and history of the work to include 1879, see pages 1470, 1475, Appendix Y, Annual Report, 1879.

Congress, by act passed August 2, 1882, appropriated $45,000 for continuing the improvement. This sum was applied to dredging and repairs and preservation of the piers bordering the canal.

The dredging up to the close of the fiscal year was mostly done in the area lying opposite the Northern Pacific Railroad docks, at the entrance to the Blast Furnace channel, and in removing bars which form annually near the bay end of the canal and at other points in the harbor.

Total quantity of material dredged during the fiscal year, 114,497 cubic yards.

Vessels drawing 14 feet of water can now reach any of the docks, and 16 feet draught can be carried through the canal. The general depth will be increased by the close of the season of 1883.

On account of the necessity for redredging certain areas every season and the commercial importance of the harbor, liberal appropriations for improvement are desirable.

In pursuance of the present plan of improvement the sum of $110,000 can be profitably expended during the fiscal year ending June 30, 1885, in about the following proportions: For dredging, $90,000; repairs to and renewal of portions of piers, $20,000:

Amount expended under present project to June 30, 1883, including outstanding liabilities		$79,070 67
Amount expended prior to present project (January, 1881)		270,651 81
Total		349,722 48
July 1, 1882, amount available		393 94
Amount appropriated by act passed August 2, 1882		45,000 00
		45,393 94
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$18,468 11	
July 1, 1883, outstanding liabilities	5,599 11	
		24,067 22
July 1, 1883, amount available		21,326 72

Amount (estimated) required for completion of existing project.....$127,988 36
Amount that can be profitably expended in fiscal year ending June 30, 1885. 110,000 00

(See Appendix D D 1.)

2. *Dredging Superior Bay, Wisconsin.*—The present plan of improvement was adopted in 1881, and contemplated by dredging—

1. Deepening the channel between the piers.

2. Dredging channel from the entry past the mouth of the Nemadji River around and parallel to the shore of Superior Bay, to Quebec Wharf.

3. Thence from Quebec Wharf along the west side of the bay to an intersection with the channel of the Saint Louis River, opposite Conner's Point.

4. Up the Nemadji River for about one-half a mile.

5. The deepening of the old Quebec Wharf channel. The dredging to afford a depth of 16 feet at low water.

Total estimated cost, $312,080, including preservation of the piers at the entry for the present.

For original projects and history of the work to include 1879, see pages 1470–1475, Appendix Y, Annual Report, 1879.

Under the appropriation of $40,000, by act of Congress passed August 2, 1882, dredging was resumed. The dredging was principally in enlarging and deepening the Quebec Wharf channel; in cutting a channel from the latter to the Northern Pacific Railroad Dock; and in deepening the channel at the entry. Quantity of material dredged and removed, 103,629 cubic yards. Some brush and stone work was also done to protect Minnesota Point from erosion.

At present vessels drawing 14 feet of water can pass through the entry up to the railroad dock. By the close of the season it is expected that 15 to 16 feet will obtain from the entry to the dock. The appropriations being small in comparison with the entire estimated cost, it is necessary in order to get the depth immediately required to sacrifice width. As appropriations are made from year to year the channels can be enlarged and deepened.

The shoaling in the entry since 1874 has been gradual, and is due mainly, in the opinion of the officer in charge, to the canal at Duluth.

In pursuance of the present plan the sum of $110,000 can be profitably expended during the fiscal year ending June 30, 1885, in about the following proportions: For dredging, $85,000; for repairs to and renewal of portions of the piers, $25,000.

Portions of the south pier need immediate renewal.

Amount expended under appropriations prior to adoption of present plan (January, 1881)		$335,513 26
Amount expended to June 30, 1883 (including outstanding liabilities), under original and present plan		370,057 80
Amount expended under present plan to June 30, 1883, including outstanding liabilities		34,474 54
July 1, 1882, amount available		4,461 58
Amount appropriated by act passed August 2, 1882		40,000 00
		44,461 58
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$14,999 81	
July 1, 1883, outstanding liabilities	6,135 77	
		21,135 58
July 1, 1883, amount available		23,326 00
Amount (estimated) required for completion of existing project		262,080 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		110,000 00

(See Appendix D D 2.)

3. *Harbor at Grand Marais, Minnesota.*—The plan for the improvement of this harbor as a harbor of refuge, adopted in 1879, provides for a breakwater jutting out from Mayhew's Point for a distance of 330 feet to narrow the entrance to the harbor and afford additional anchorage ground, and the further enlargement, by dredging, of the area bounded by Mayhew's Point and inner shore line, so as to afford anchorage ground for vessels drawing 16 feet of water.

At the close of the last fiscal year 280 linear feet of breakwater had been constructed, lacking but three courses of timber to complete it.

Under the appropriation of $20,000, made by act of August 2, 1882, the completion of the breakwater to a height of 8 feet above low water, and its extension to a length of 330 feet by adding a pier-head 50 feet long, 40 feet wide, and to rise to the same height above low water, as the rest of the breakwater, viz, 8 feet, were decided upon, as well as further dredging of the harbor area. Both to be finished during the coming season.

Before this work of improvement was undertaken there was no harbor of refuge on the north shore of Lake Superior between Duluth and the British Possessions to the east, the need of such a harbor in American interests being more appreciable every year as the commerce of Lake Superior and the interests of the north shore develop.

Vessels drawing 15 to 16 feet of water can now make the harbor of Grand Marais and ride out storms from any direction.

The sum of $25,000 can be profitably expended during the fiscal year ending June 30, 1885, in enlarging and deepening the harbor area, and in care of and necessary repairs to piers. As the piers are liable to suffer damage from storms there should always be funds available for their maintenance.

Total amount expended to June 30, 1883, including outstanding liabilities		$40,188 71
Estimated cost of original project		139,669 40
Remaining to be appropriated		79,669 40
July 1, 1882, amount available		3,577 61
Amount appropriated by act passed August 2, 1882		20,000 00
		23,577 61
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$849 08	
July 1, 1883, outstanding liabilities	2,917 24	
		3,766 32
July 1, 1883, amount available		19,811 29
Amount (estimated) required for completion of existing project		79,669 40
Amount that can be profitably expended in fiscal year ending June 30, 1885		25,000 00

(See Appendix D D 3.)

HARBORS ON LAKE SUPERIOR (EAST OF SUPERIOR CITY), ON GREEN BAY, AND ON THE WESTERN SHORE OF LAKE MICHIGAN NORTH OF MILWAUKEE, WISCONSIN.

Officers in charge, Lieut. Col. Henry M. Robert, Corps of Engineers, to May 31, 1883; Maj. J. W. Barlow, Corps of Engineers, to June 22, 1883; Capt. F. A. Hinman, Corps of Engineers, in temporary charge.

1. *Ontonagon Harbor, Michigan.*—Previous to the improvement of this harbor the entrance at the mouth of the river was variable in position, with not more than 7 feet of water at the shoalest point.

The present project was adopted in 1867, and comprised the construction of parallel piers from the river mouth to the 18-foot curve in the lake, with dredging between them, so as to afford a channel of entrance of navigable width and not less than 12 feet deep.

The amount expended to June 30, 1883, is $240,627.14, of which $12,592.90 was expended during the last fiscal year. This has resulted in 750 linear feet of pile pier and revetment, and 3,540 linear feet of crib pier, and the removal of 10,546½ cubic yards of sand from the outer bar, giving a channel 150 feet wide with not less than 11 feet water.

During the fiscal year ending June 30, 1883, two cribs were built and placed in extension of the piers, and partial superstructure was constructed over thirteen cribs.

During the fiscal year ending June 30, 1884, the present contract will be completed by placing five additional cribs and building partial superstructure over four cribs.

The appropriation of $60,000 asked for during the fiscal year ending June 30, 1885, is for further extension of the piers.

The officer in charge recommends that no appropriation be made specifically for dredging, as such work is of but temporary benefit, and all available funds should be applied to the rapid extension of the piers in order to secure a permanent channel.

July 1, 1882, amount available		$565 76
Amount appropriated by act passed August 2, 1882		20,000 00
		20,565 76
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,592 90	
July 1, 1883, outstanding liabilities	1,040 70	
		4,633 60
July 1, 1883, amount available		15,932 16
Amount (estimated) required for completion of existing project		106,170 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		60,000 00

(See Appendix E E 1.)

2. *Eagle Harbor, Michigan.*—The entrance to this harbor was originally obstructed by a rocky reef, having about 9 feet of water at the shoalest point. The project for its improvement was adopted in 1866 and modified in 1868, 1874, and 1877. It included the blasting of a channel across the reef, having a width of 130 feet, a depth of 14 feet, and marked by a guiding-crib on each side.

The work was completed in 1879 as far as the present demands of commerce require. The expenditures to June 30, 1883, have been $93,197.47.

During the past fiscal year slight repairs to the guiding-cribs were made.

The funds available for this work are necessary to provide for repairs which may be required at any time and are ample for some years to come.

No appropriation is asked.

July 1, 1882, amount available		$3,867 53
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		65 00
July 1, 1883, amount available		3,802 53

(See Appendix E E 2.)

3. *Marquette Harbor, Michigan.*—The project for the construction of a breakwater at this harbor was adopted in 1866 and completed by June

30, 1876, at a cost of $290,646.55, or $94,483.03 less than estimated. Since then $13,460.31 has been expended on repairs, of which $6,574.32 was expended during the past fiscal year in removing defective timber from the outer 1,050 linear feet, filling the same with stone and redecking it. During the fiscal year ending June 30, 1884, this repair work will be continued to completion.

No appropriation is asked for this harbor for the fiscal year ending June 30, 1885, since the present project is completed and available funds on hand are sufficient to meet the contingency of repair.

The breakwater should be eventually extended 400 linear feet, at an estimated cost of $68,000.

July 1, 1882, amount available		$697 46
Amount appropriated by act passed August 2, 1882		16,000 00
		16,697 46
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		6,574 32
July 1, 1883, amount available		10,123 14
Amount (estimated) required for completion of existing project		68,000 00

(See Appendix E E 3.)

4. *Harbor of Refuge at Grand Marais, Michigan.*—The project for this harbor was adopted in 1881, upon the report of a Board of Engineers. The object of the improvement is to furnish a harbor of refuge to the commerce of Lake Superior by making an artificial entrance into the harbor, having a channel of 18 to 20 feet depth, with a least width of 300 feet between piers 500 feet apart. The natural channel is not more than 6 feet deep and shifting.

The amount expended to June 30, 1883, is $10,415.77, of which $8,253.63 was expended in the past fiscal year. The expenditures have been applied to the surveys and examinations necessary for the development of the project, the removal of 19,029 cubic yards of material, and the placing of five cribs in the west pier.

During the fiscal year ending June 30, 1883, the above-named dredging and pier extension have been accomplished.

The appropriation asked for the fiscal year ending June 30, 1885, is for the purpose of further pier extension and dredging. The isolated location of this work, and the fact that no advantage will accrue from it to commerce until about $300,000 have been expended, are reasons for urging large annual appropriations.

July 1, 1882, amount available			$27,837 86
Miscellaneous receipts			84 00
Amount appropriated by act passed August 2, 1882			40,000 00
			67,921 86
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$8,253 63		
July 1, 1883, outstanding liabilities	1,939 98		
		10,193 61	
July 1, 1883, amount available			57,728 25
Amount (estimated) required for completion of existing project			380,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885			200,000 00

(See Appendix E E 4.)

5. *Manistique Harbor, Michigan.*—By the acts of 1880 and 1881 the sum of $6,000 was appropriated for this harbor in order to dredge a channel of 150 feet width and 12 feet depth between piers built by a local lum-

bering company. Dredging was done to the amount of 11,780 cubic yards, and the work was then suspended by reason of the refusal of the company controlling the harbor to rectify their pier-lines when rebuilding the same.

No appropriation is asked for this harbor.

July 1, 1882, amount available	$3,583 11
July 1, 1883, amount available	3,583 11

(See Appendix E E 5.)

6. *Harbor at the mouth of Cedar River, Michigan.*—The project for this harbor proposes to afford a channel of navigable width from the shore-line to the 16-foot curve in the bay, by building piers, each 1,200 feet in length, and dredging between them to 14 feet depth, at a cost of $138,000. The natural entrance was covered by a bar having less than 3 feet of water; this was improved by private enterprise so as to give a channel of 8 feet depth for a widtn of 50 feet.

The amount expended to June 30, 1883, is $580.62; all of which was expended during the past fiscal year, and has been applied towards developing the project and starting the work.

During the fiscal year ending June 30, 1884, the present contract will be completed by building about 550 linear feet of pile pier.

The appropriation asked for the fiscal year ending June 30, 1885, is for further pier extension.

Amount appropriated by act passed August 2, 1882	$15,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	580 62
July 1, 1883, amount available	14,419 38
Amount (estimated) required for completion of existing project	123,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	40,000 00

(See Appendix E E 6.)

7. *Menomonee Harbor, Michigan and Wisconsin.*—The project for this harbor was adopted in 1871 and modified in 1874, its object being to afford a channel of navigable width and not less than 14 feet depth by pier extension and dredging. The natural channel was covered by a bar, having on it not more than 6 feet of water for a width of 200 feet.

The amount expended to June 30, 1883, is $175,601.49, of which $603.35 was expended in the last fiscal year.

The expenditures have been applied to the construction of 585 linear feetof slab pier, 2,777 linear feet of pile pier, 1,200 linear feet of crib pier, and the dredging of 205,828 cubic yards of material. The result is a low-water channel 200 feet wide, with not less than 12 feet of water, and included therein a 14-foot channel 100 feet wide.

During the past fiscal year 3,950 cubic yards of material were removed from the channel between the piers.

During the fiscal year ending June 30, 1884, five cribs will be sunk and the superstructure will be continued.

The appropriation asked for the fiscal year ending June 30, 1885, will be applied to further pier extension and necessary dredging.

July 1, 1882, amount available	$1 86
Amount appropriated by act passed August 2, 1882	15,000 00
	15,001 86
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	603 35
July 1, 1883, amount available	14,398 51

Amount (estimated) required for completion of existing project.....	$22,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	22,000 00

(See Appendix E E 7.)

8. *Oconto Harbor, Wisconsin.*—The first appropriation for this work, made by the act of March 3, 1881, was withheld from expenditure until the sense of Congress could be ascertained upon a full estimate for the improvement.

The project proposes to secure an 8-foot channel from deep water in Green Bay to the city of Oconto by dredging, and the construction of piers at an estimated cost of $150,000. The natural entrance to the Oconto River had less than 2 feet of water in its channel. After some improvement at the mouth of the river, the local efforts were directed to forming an artificial entrance where they have built 1,000 linear feet of slab pier and opened a shallow channel by dredging.

The amount expended to June 30, 1883, is $7,541.10, all of which was expended during the past fiscal year. This has resulted in the construction of 300 linear feet of slab pier. This was the initial work of improvement at this harbor.

A dredge and two dump-scows were built and a tug purchased in connection with three other harbors.

During the fiscal year ending June 30, 1884, it is proposed to complete the existing contract by building 2,700 linear feet of slab pier.

The appropriation asked for the fiscal year ending June 30, 1885, will be expended on further pier extension and dredging.

July 1, 1882, amount available.....		$10,000 00
Amount appropriated by act passed August 2, 1882		15,000 00
		25,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882.....	$7,541 10	
July 1, 1883, outstanding liabilities.....	832 11	
		8,373 21
July 1, 1883, amount available.....		16,626 79
Amount (estimated) required for completion of existing project		100,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		50,000 00

(See Appendix E E 8.)

9. *Pensaukee Harbor, Wisconsin.*—The project for improving this harbor was adopted in 1881.

It is proposed to construct an extension of the existing 1,600 linear feet of single slab pier, built by private enterprise, for 2,500 linear feet further and to dredge a cut 100 feet wide and 10 feet deep, from the bay into the harbor, at an estimated cost of $50,000.

The natural channel was not over 2 feet in depth, but by private enterprise this has been increased to 10 feet for a width of about 30 feet.

The amount expended to June 30, 1883, is $685.15, all of which was expended during the past fiscal year.

During the past fiscal year a survey was made of the river mouth and vicinity, and work commenced late in June, 1883, on the proposed pier extension.

During the fiscal year ending June 30, 1884, 1,300 linear feet of slab pier will be built.

The appropriation asked for the fiscal year ending June 30, 1885, is for further pier extension.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		685 15
July 1, 1883, amount available		9,314 85
Amount (estimated) required for completion of existing project		40,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		30,000 00

(See Appendix E E 9.)

10. *Green Bay Harbor, Wisconsin.*—The project for the improvement of this harbor was adopted in 1866, and modified in 1872 and 1881, its object being to secure a channel 200 feet wide and 14 feet deep, for 2 miles, between the mouth of Fox River and deep water in Green Bay, including a revetted cut across Grassy Island. The natural channel was circuitous and narrow, with but 6 feet of water at its shoalest point.

The expenditures, to June 30, 1883, were $247,641.82, and have resulted in a channel over 2 miles long, 200 feet wide, and 13 feet deep at low water for one-half its width, 10 feet over the other half; also 1,320 linear feet of revetment.

During the past fiscal year the sum of $7,091.82 was expended in widening and deepening the channel by removing 43,524 cubic yards of material therefrom.

During the fiscal year ending June 30, 1884, dredging of about 0,000 cubic yards is contemplated.

The appropriation asked for the fiscal year ending June 30, 1885, is for continuation of dredging.

Amount appropriated by act passed August 2, 1882			$20,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$7,091 82		
July 1, 1883, outstanding liabilities	739 91		
		7,831 73	
July 1, 1883, amount available			12,168 27
Amount (estimated) required for completion of existing project			47,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885			40,000 00

(Appendix E E 10.)

11. *Harbor of Refuge at entrance of Sturgeon Bay Canal, Wisconsin.*—The project for the improvement of this harbor was adopted in 1873, and modified in 1879, and again in 1880, the object being to protect the lake entrance of the canal, and to afford an outer basin of navigable width, and of at least 13 feet depth. The project as modified comprises two sand-tight piers, each about 1,200 feet long, converging over the mouth of the canal, to an entrance 235 feet wide, whence detached piers extend 150 feet further, widening the entrance to 335 feet; also a double row of fender-piling at the entrance, and the dredging of the small harbor thus formed so as to secure a least depth of 16 feet therein. The modifications of the original project consisted of 1,392 linear feet of sheathing for the pile piers, 330 linear feet of fender-piling, and 300 linear feet of crib pier at the entrance; but they will not add to the estimated cost of the work as a whole, which is $180,000.

The expenditures to June 30, 1883, have aggregated $139,006,65, resulting in 1,600 linear feet of revetted pile pier, 1,100 linear feet of crib pier, 330 linear feet of fender-piling, and 38,415 cubic yards of dredging, which completes the piers as projected, excepting some superstructure, and gives a channel about 100 feet wide and 16 feet deep from the lake to the canal entrance.

During the past fiscal year the sum of $9,029.12 was expended in building a dredge, two dump-scows, and the purchase of a tug, in connection with three other harbors, and dredging 21,368 cubic yards of material.

During the fiscal year ending June 30, 1884, 40,000 cubic yards of dredging will be done.

The appropriation asked for the fiscal year ending June 30, 1885, will be applied to completing the superstructure and dredging.

In compliance with a resolution of the United States Senate, a Board of Engineer Officers was appointed who reported on the cost of the canal and the amount realized by the canal company from the sale of lands granted by Congress to the State of Wisconsin to aid in the construction of said canal.

July 1, 1882, amount available		$22 47
Amount appropriated by act passed August 2, 1882		20,000 00
		20,022 47
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$9,029 12	
July 1, 1883, outstanding liabilities	2,634 75	
		11,663 87
July 1, 1883, amount available		8,358 60
Amount (estimated) required for completion of existing project		30,000 00
Amount that can be profitably expended is fiscal year ending June 30, 1885.		30,000 00

(See Appendix E E 11.)

12. *Ahnepee Harbor, Wisconsin.*—The present project was adopted in 1875, and modified in 1880 by the addition of sand-tight sheathing to the pile piers, the object being to afford a limited inner harbor, and an entrance channel of not less than 12 feet in depth. The natural channel was narrow, with a least depth of 1 foot.

The amount expended to June 30, 1883, including expenditures prior to the adoption of the present project, is $124,874.23, resulting in a channel 50 feet wide, with a least depth of 10 feet, and deepening a channel through the inner harbor. This was done by the construction of 975 linear feet of pile pier, 800 linear feet of crib pier, and the removal of 77,865 cubic yards of sand and mud, and about 15,800 cubic yards of rock. Besides the above work, the city of Ahnepee expended $1,803.78 in blasting a channel through the rocky bed of the river above the bridge.

During the past fiscal year twelve cribs were built, of which number nine were sunk in extension of the piers and the remaining three cribs left on hand to be placed under subsequent appropriations. These cribs were built from timber obtained from the Government reservation at Sturgeon Bay. Twenty-three thousand five hundred and eighty-seven cubic yards of sand and mud were removed from the channel between the piers and from the inner harbor, and 4,820 cubic yards of limestone rock were blasted for the channel through the river bed. This work was done by the United States dredge. Eight hundred and sixty cords of the rock removed from the river bed were used in filling the aforesaid nine cribs sunk in extension of the piers.

No work is contemplated during the fiscal year ending June 30, 1884, as the work done during the past fiscal year exhausted available funds.

The appropriation asked for the fiscal year ending June 30, 1885, will be applied to further pier extension and rock removal.

The present incomplete condition of the pier extension renders the

use of the harbor dangerous to vessels attempting to enter during storms.

July 1, 1882, amount available	$5,271 75
Amount appropriated by act passed August 2, 1882	12,000 00
	17,271 75
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	17,145 98
July 1, 1883, amount available	125 77
Amount (estimated) required for completion of existing project	50,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	50,000 00

(See Appendix E E 12.)

13. *Kewaunee Harbor, Wisconsin.*—The project for the improvement of this harbor was adopted in 1881, its object being to abtain a channel having a least depth of 12 feet by an artificial entrance,, with piers from the shore line to the 18-foot curve, at an estimated cost of $200,000. The natural entrance was not more than 20 feet wide, with a depth of about 2 feet at the shoalest point, and covered by an extensive reef of bowlders.

The expenditures to June 30, 1883, are $15,897.20, of which $8,042.72 was defrayed by the town of Kewaunee.

During the past fiscal year $5,724.75 were expended, resulting in the completion of 275 linear feet, and the construction of 100 linear feet of pile pier.

No harbor facilities can be obtained until the piers are further extended and a cut dredged across the spit separating the river from the lake.

During the fiscal year ending June 30, 1884, it is proposed to complete the present contract by building 400 linear feet of pile pier.

The appropriation asked for the fiscal year ending June 30, 1885, will be applied to further pier extension and dredging.

July 1, 1882, amount available		$2,870 27
Miscellaneous receipts		14 00
Amount appropriated by act passed August 2, 1882		12,000 00
		14,884 27
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$5,724 75	
July 1, 1883, outstanding liabilities	178 32	
		5,903 07
July 1, 1883, amount available		8,981 20
Amount (estimated) required for completion of existing project		174,957 28
Amount that can be profitably expended in fiscal year ending June 30, 1885.		50,000 00

(See Appendix E E 13.)

14. *Two Rivers Harbor, Wisconsin.*—The project for the improvement of this harbor was adopted in 1870 and modified in 1877, its object being to afford a channel of navigable width and not less than 12 feet in depth, by dredging to 14 feet, and building piers to the 18-foot curve. The natural entrance had but 2 to 3 feet of water over the bar covering it.

The expenditures to June 30, 1883, have aggregated $185,008.44, of which $10,025.80 were expended during the past fiscal year, resulting in 2,018 linear feet of revetted pile pier, 1,500 linear feet of crib pier, and 180,542 cubic yards of dredging, giving a channel from 75 to 100 feet wide, having a least depth at low water of 10 feet between the piers and an average depth of over 10 feet in the inner harbor.

During the past fiscal year two cribs were placed in extension of the south pier, and partial superstructure built over 500 linear feet of the same pier; 26,436 cubic yards of material were removed by hired labor and use of the United States dredge.

During the fiscal year ending June 30, 1884, it is proposed to remove by hired labor and use of the United States dredges about 60,000 cubic yards of material from the channel between the piers.

The appropriation asked for the fiscal year ending June 30, 1885, will be applied to further pier extension and dredging.

July 1, 1882, amount available	$17 36
Amount appropriated by act passed August 2, 1882	15,000 00
	15,017 36
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	10,025 80
July 1, 1883, amount available	4,991 56
Amount (estimated) required for completion of existing project	75,588 80
Amount that can be profitably expended in fiscal year ending June 30, 1885.	50,000 00

(See Appendix E E 14.)

15. *Manitowoc Harbor, Wisconsin.*—The project for the improvement of this harbor was adopted in 1866 and modified in 1872 and in 1881, its object being to afford a channel of navigable width and not less than 14 feet depth at low water, at a total estimated cost of $308,182.54. The natural entrance was only about 3 feet deep at the shoalest point.

The expenditures to June 30, 1883, have aggregated $251,262.70, of which $7,473.03 were expended in the last fiscal year.

The expenditures have resulted in 3,370 linear feet of crib pier and 156,877 cubic yards of dredging, giving a channel 200 feet wide and 18 feet deep, gradually diminishing in depth to 14 feet at the shore-line.

During the past fiscal year 38,492 cubic yards of material were removed from the channel between the piers by contract, hired labor, and the United States dredge.

During the fiscal year ending June 30, 1884, contingent repairs to the piers is the only work contemplated.

The appropriation asked for the fiscal year ending June 30, 1885, will be applied to pier extension.

July 1, 1882, amount available		$30 33
Amount appropriated by act passed August 2, 1882		10,000 00
		10,030 33
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$7,473 03	
July 1, 1883, outstanding liabilities	49 15	
		7,522 18
July 1, 1883, amount available		2,508 15
Amount (estimated) required for completion of existing project		54,362 54
Amount that can be profitably expended in fiscal year ending June 30, 1885.		54,400 00

(See Appendix E E 15.)

16. *Sheboygan Harbor, Wisconsin.*—The projects for the improvement of this harbor from 1852 to 1873 were completed within their estimated cost, and had for their object to obtain a 12-foot channel by piers to the 12-foot curve in the lake and dredging. In 1873 the project was modified to secure a deeper channel—how much not being stated—by further

pier extension and dredging. The present project was adopted in 1881; its estimated cost is $150,000, and its object is to carry the piers rapidly over the bar to the 20-foot curve, with dredging to secure a channel of 18 feet at the entrance and 14 feet at the shore line. The natural channel had not to exceed 4 feet depth of water.

The total expenditures by the United States have aggregated $226,400.67. Besides this a considerable sum (about $55,000) was expended by the city and county of Sheboygan. The results are 3,581 linear feet of pier and 125,251 cubic yards of dredging, giving a channel which at present carries not more than 12 feet of water for a width of about 100 feet.

During the past fiscal year the sum of $30,611.36 was expended in dredging 5,408 cubic yards of material, and building 374 linear feet of pier; also in building a dredge and two dump-scows, and the purchase of a tug, in connection with three other harbors.

During the fiscal year ending June 30, 1884, the work of pier extension now under contract will be completed, comprising three cribs and superstructure over five cribs. Dredging necessary to keep the channel open will also be done.

The appropriation asked for the fiscal year ending June 30, 1885, will be used in further pier extension and dredging. The only means of securing a permanent channel is stated by the officer in charge to consist in rapid extension of the piers to deep water; hence a liberal appropriation is urged as a matter of economy and of necessity to the commerce of this important harbor.

Amount appropriated by act passed August 2, 1882		$30,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$10,951 76	
July 1, 1883, outstanding liabilities	4,416 63	
		15,368 39
July 1, 1883, amount available		14,631 61
Amount (estimated) required for completion of existing project		95,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		90,000 00

(See Appendix E E 16.)

17. *Port Washington Harbor, Wisconsin.*—The project for the improvement ot this harbor was adopted in 1869 and modified in 1870, 1876, and 1881, its object being to afford a channel of navigable width with interior basins, having a least depth of 12 feet, including piers to the 14-foot curve. The natural channel was very narrow, with not more than 1 foot in depth at the shoalest point.

The expenditures to June 30, 1883, have aggregated $151,967.37, resulting in 406 linear feet of pile revetment, 1,690 linear feet of crib pier, and 226,000 cubic yards of dredging between the piers and in the basins, giving a channel 75 feet wide and 10 feet deep, with two interior basins from 8 to 12 feet in depth, and a combined area of $5\frac{3}{4}$ acres.

During the past fiscal year the sum of $17,199.12 was expended in placing one crib and building superstructure over 700 linear feet of pier, and also in building a dredge, two dump-scows, and purchase of a tug in connection with three other harbors.

During the fiscal year ending June 30, 1884, no work is contemplated beyond the contingency of slight repair to the piers.

The appropriation asked for the fiscal year ending June 30, 1885, will be used in further pier extension and dredging.

Miscellaneous receipts		$20 00
Amount appropriated by act passed August 2, 1882		17,000 00
		17,020 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$14,467 37	
July 1, 1883, outstanding liabilities	2,469 68	
		16,937 05
July 1, 1883, amount available		82 95
Amount (estimated) required for completion of existing project		27,027 17
Amount that can be profitably expended in fiscal year ending June 30, 1885		27,000 00

(See Appendix E E 17.)

CONSTRUCTION OF HARBOR OF REFUGE, MILWAUKEE BAY—IMPROVEMENT OF THE HARBORS OF MILWAUKEE, RACINE, KENOSHA, AND WAUKEGAN, LAKE MICHIGAN—IMPROVEMENT OF FOX AND WISCONSIN RIVERS.

Officer in charge, Lieut. Col. D. C. Houston, Corps of Engineers, with Capt. F. A. Hinman, Corps of Engineers, under his immediate orders to June 18, 1883.

1. *Harbor of Refuge, Milwaukee Bay, Wisconsin.*—During the year ending June 30, 1883, the breakwater has been extended southward 750 feet without superstructure. During the present season 300 feet will be added, making a total length of 2,450 feet. The outer 150 feet will be raised to 6 feet above water, and the rest of the work to 2 feet. This will exhaust the available funds. The outer end of the breakwater will be in a depth of 28 feet.

There has been expended on this work up to June 30, 1883, $109,255.15.

It is recommended, for reasons stated under the head of Improvement for Milwaukee Harbor, that the appropriations hereafter be under one head, viz, Harbor of Refuge, Milwaukee Bay and Milwaukee Harbor, Wisconsin.

July 1, 1882, amount available		$42,759 90
Amount appropriated by act passed August 2, 1882		100,000 00
		142,759 90
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$49,634 17	
July 1, 1883, outstanding liabilities	2,380 88	
		52,015 05
July 1, 1883, amount available		90,744 85
Amount (estimated) required for completion of existing project		600,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		300,000 00

(See Appendix F F 1.)

2. *Milwaukee Harbor, Wisconsin.*—The original depth of water at the entrance to this harbor was at times not more than 3½ feet, and the principal commerce of the port was conducted from wharves in the open lake.

The present plan of improvement was adopted in 1852, and consisted originally in cutting a channel from the river to the lake, known as the "North Cut," and the construction of parallel piers for its protection so as to give a navigable depth of 12 feet. Since then the piers have been extended and the channel deepened so that there is now a channel 18 feet deep and of sufficient width. There was expended on this har-

bor up to June 30, 1882, by the United States $269,740.22, in addition to $321,355.66 expended by the city of Milwaukee, with the results above stated.

No work has been done during the year ending June 30, 1883.

It is estimated that an average annual expenditure of $10,000 will probably be necessary for the maintenance of this harbor by pier-work and dredging. As this amount is irregular, some years much less being necessary, no special estimate is made for this harbor for the fiscal year ending June 30, 1885, but it is recommended that the appropriations for harbor of refuge, Milwaukee Bay and Milwaukee Harbor, Wisconsin, be made under one head, so much of the same as may be necessary to be applied to maintaining the channel and works at the river mouth.

July 1, 1882, amount available	$5,107	95
Amount appropriated by act passed August 2, 1882	10,000	00
	15,107	95
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	979	32
July 1, 1883, amount available	14,128	63

(See Appendix F F 2.)

3. *Racine Harbor, Wisconsin.*—The original depth of water at the entrance to this harbor was not more than 6 feet at any time, generally less, and at times the entrance was entirely closed. The present plan of improvement was adopted in 1843, and consisted originally in the construction of parallel piers at the river mouth, and dredging between them, so as to obtain a navigable channel of 12 feet. The piers have been continually extended to exclude the drift along the shore, and to provide for deepening the channel to 15 feet or more.

There was expended on this harbor up to June 30, 1882, $208,906.04, resulting in a navigable channel of 14 feet. No work has been done during the year ending June 30, 1883, except some repairs to the outer end of the south pier.

It is proposed to expend the balance available for this harbor the present season in deepening the channel between the piers and making necessary repairs to the north pier.

It is proposed to expend the amount estimated for the year ending June 30, 1885, in extending the south pier in the manner explained in the appendix, in dredging, and necessary repairs.

It is estimated that an everage annual expenditure of $8,000 is required for the maintenance of this harbor.

July 1, 1882, amount available	$1,133	18
Amount appropriated by act passed August 2, 1882	7,000	00
	8,133	18
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	1,245	39
July 1, 1883, amount available	6,887	79
Amount (estimated) required for completion of existing project	35,000	00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	35,000	00

(See Appendix F F 3.)

4. *Kenosha Harbor, Wisconsin.*—The original depth of water at the entrance to this harbor never exceeded 4 feet, and the entrance was entirely closed by northeast storms. The present plan of improvement consisted in the construction of two parallel piers at the river mouth, and dredging between them, so as to obtain a navigable depth of 12

feet. Since then it has been expected to obtain a depth of 15 feet or more by extending the piers and dredging.

There was expended on this harbor, up to June 30, 1882, $205,074.64, resulting in a navigable channel with a depth not less than 11½ feet.

During the year ending June 30, 1883, superstructure was built over 100 feet of the extension of the north pier, and 290 feet of old superstructure on same pier was replaced by new work. There is at present a navigable channel of 11 feet. The balance available will be expended in making necessary repairs.

It is proposed to apply the amount estimated for the year ending June 30, 1885, to pier extension, repairs, and dredging.

It is estimated that an average annual expenditure of $8,000 is required for the maintenance of this harbor.

July 1, 1882, amount available	$878 93
Amount appropriated by act passed August 2, 1882	6,000 00
	6,878 93
July, 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4,537 68
July 1, 1883, amount available	2,341 25
Amount (estimated) required for completion of existing project	51,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	16,000 00

(See Appendix F F 4.)

5. *Waukegan Harbor, Illinois.*—The present project was adopted in 1880, the object being to inclose a small basin by projecting piers into the lake so as to protect vessels. The original plan has been modified by reducing the size of the basin with a view to obtaining the additional room needed, by dredging a channel from the basin through the low ground between the lake and the bluffs. This harbor will not be available for purposes of commerce until the piers are sufficiently extended to give the protection necessary for dredging in the basin and proposed channel.

There has been constructed during the year 390 feet of the south pier, commencing at a point on the shore-line 900 feet south of the north pier.

There has been expended on this harbor up to June 30, 1883, $40,056.14.

The balance available will be expended this season in extending the south pier about 177 feet.

The limited appropriations which have been made for this harbor rendered it necessary to change the original plan made in 1879. Prices have also advanced, and a revised estimate for completion has been made by the officer in charge, amounting to $111,000, as below.

It is proposed to apply the amount estimated for the year ending June 30, 1885, to completing the pier-work at a cost of $45,000, and dredging a channel through the low ground between the lake and the bluffs. It is important that the pier extension proceed as rapidly as possible to prevent the filling in by the action of storms and the consequent increase of cost of the work.

July 1, 1882, amount available	$12,990 53
Amount appropriated by act passed August 2, 1882	20,000 00
	32,990 53
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	24,312 32
July 1, 1883, amount available	8,678 21

Amount (estimated) required for completion of existing project.....$111,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885. 75,000 00

(See Appendix F F 5.)

6. *Fox and Wisconsin Rivers, Wisconsin.*—The general condition of this work is given in the Annual Report of the Chief of Engineers for 1882. During the year ending June 30, 1883, the following work has been done:

Fox River.—Lower Fox.—Constructing a retaining wall for canal bank above Kaukauna first lock; laying coping on walls of said lock; quarrying, dressing, and transporting stone for new locks; commencing construction of new first lock at Appleton; commencing alterations of dams at Menasha and Appleton, required by the river and harbor act approved August 2, 1882; constructing a new hull for Dredge No. 1; making necessary repairs to locks, dams, and canal banks.

The work of altering the Menasha Dam was suspended on account of an order of the circuit court of Winnebago County, Wisconsin, on the application of private parties claiming that their property would be injured. The suit was transferred to the United States circuit court for the eastern district of Wisconsin, where it is now pending.

Upper Fox.—The work of deepening and widening the channel by dredging was continued; 124,208 cubic yards were excavated and removed from the channel, and necessary repairs made to locks, dams, canal banks, &c.

Wisconsin River.—Nine thousand three hundred and twenty linear feet of wing-dams were constructed during the year, reducing the width of the low-water channel to 300 feet for a distance of nearly 10 miles below Portage.

The balance available will be applied as follows:

Fox River.—Alterations in dams at Menasha and Appleton; construction of Appleton first lock; repairs of locks, dams, and canal banks; maintenance of works, operating locks, care of property, &c.

The whole subject of the improvement of the Fox and Wisconsin Rivers has been referred to the Board of Engineers for Fortifications and River and Harbor Improvements, and it is expected that the Board will make a report in time for the next session of Congress.

Future work on the improvement will depend, in a great measure, on the report of the Board.

The estimate now submitted is for the continuation of the work on the plan heretofore pursued.

July 1, 1882, amount available	$47,354 10
Tolls received and deposited to credit of appropriation	625 00
Fuel sold to officers deposited to credit of appropriation	178 75
Amount appropriated by act passed August 2, 1882	200,000 00
	248,157 85
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	113,390 78
July 1, 1883, amount available	134,767 07
Amount (estimated) required for completion of existing project	2,125,663 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	500,000 00

(See Appendix F F 6.)

IMPROVEMENT OF THE HARBORS OF CHICAGO AND CALUMET, LAKE MICHIGAN—IMPROVEMENT OF ILLINOIS RIVER—SURVEYS FOR HENNEPIN CANAL, AND FOR THE ENLARGEMENT OF THE ILLINOIS AND MICHIGAN CANAL.

Officer in charge, Maj. W. H. H. Benyaurd, Corps of Engineers.

1. *Chicago Harbor, Illinois.*—The project of improvement now in course of execution at this harbor was adopted in 1870, and modified in 1878. The objects sought are, *first*, the formation of an outer harbor, adjoining the entrance to the Chicago River, and designed also to furnish increased commercial facilities, by relieving the river from its overcrowded condition; *second*, the creation of a harbor of refuge affording a good anchorage in deep water and safe access to the harbor and river.

The amount expended upon the work for the harbor at Chicago since 1870 is $1,133,518.79, and has resulted in the completion of the outer harbor (except the dredging necessary to afford the contemplated depth of 16 feet) and the completion of 2,436 feet of the exterior breakwater.

In addition to needed repairs, the material and available funds now on hand will complete about 1,000 feet more of the breakwater, leaving 2,000 linear feet still to be finished. For the continuation of this work $200,000 is asked. The work of deepening the outer harbor will also be continued, and it is proposed to excavate about 150,000 yards during the next season, which will require $30,000 additional.

July 1, 1882, amount available		$41,852 55
Amount appropriated by act passed August 2, 1882		200,000 00
		241,852 55
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$130,843 85	
July 1, 1883, outstanding liabilities	65,357 30	
		196,201 15
July 1, 1883, amount available		45,651 40
Amount (estimated) required for completion of existing project		384,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		200,000 00

(See Appendix G G 1.)

2. *Calumet Harbor, Illinois.*—The present project for the improvement of this harbor has for its object the creation and maintenance of a channel 300 feet wide and 16 feet deep from Lake Michigan to Calumet River.

The amount expended in the execution of this project to June 30, 1883, is $331,340.89; 4,860 linear feet of pier work have been completed, and 361,990 cubic yards of material have been dredged from the channel. During the coming season, with the funds now available, the north pier will be extended a further distance of 300 feet, and the channel will be dredged throughout to a depth of 16 feet.

The appropriation of $41,400 asked for is to be applied to extending the south pier a further distance of 500 feet, and to the repair and preservation of the existing piers. With the completion of this work it is believed that no further work will be needed for the present. Some dredging may hereafter be necessary, due to the partial filling up of the channel.

To comply with the requirements of the provision of the river and harbor act of August 2, 1882, in regard to the improvement of the Calumet River, Illinois, a Board of Engineer Officers was convened to consider the subject, and the report thereon was transmitted to the Senate

December 9, 1882, and printed as Senate Ex. Doc. No. 9. See also Appendix G G 2 to this report.

July 1, 1882, amount available		$1,013 45
Amount appropriated by act passed August 2, 1882		35,000 00
		36,013 45
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$5,354 34	
July 1, 1883, outstanding liabilities	24,286 73	
		29,641 07
July 1, 1883, amount available		6,372 38
Amount (estimated) required for completion of existing project		41,400 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		41,400 00

(See Appendix G G 2.)

3. *Illinois River.*—From 1869 to 1880 the improvement of this river, as carried on by the General Government, consisted chiefly in dredging channels through the worst bars, and in constructing wing-dams and dikes. This work was designed to afford temporary relief to navigation and to ultimately constitute a part of the radical improvement of the river by the slack-water system. The amount expended in that way to June 30, 1880, was $550,450.55.

The State of Illinois has constructed two large locks on the river, at Henry and at Copperas Creek. The present project comtemplates the extension of this slack-water system of improvement 100 miles farther down. This is to be accomplished by the construction of two more locks and dams and by dredging that part of the river channel between the lowest State lock at Copperas Creek and the mouth of the river.

Work upon the foundations of both locks was commenced late in the summer of 1882, operations having been greatly retarded by the high stage of water that prevailed in the river. At the close of the season both foundations were nearly completed and arrangements made for commencing the masonry work so soon as the approval of the honorable the Attorney-General was obtained to the title of the land. This land for the lock sites was condemned by the United States circuit court at Springfield June 22 last, but at the close of the fiscal year the proceedings in the case had not been acted upon. Since that date the titles have received the approval of the Attorney-General.

With the funds now on hand the foundations of both locks will be completed and the walls and abutments of the La Grange Lock will be finished. The amount of $350,000 asked for the fiscal year ending June 30, 1885, will be applied to finishing the Kampsville Lock and building the dams at both places.

July 1, 1882, amount available		$281,319 53
Amount appropriated by act passed August 2, 1882		175,000 00
		456,319 53
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$150,685 23	
July 1, 1883, outstanding liabilities	15,120 12	
		165,805 35
July 1, 1883, amount available		290,514 18
Amount (estimated) required for completion of existing project		547,150 55
Amount that can be profitably expended in fiscal year ending June 30, 1885.		350,000 00

(See Appendix G G 3.)

4. *Surveys for the Hennepin Canal and for the enlargement of the Illinois and Michigan Canal.*—Under the requirements of the river and

harbor act of August 2, 1882, directing the survey and location of a canal from a point on the Illinois River at or near the town of Hennepin by the most practicable and convenient route to the Mississippi River, at or above the city of Rock Island, a survey was made under the direction of Maj. W. H. H. Benyaurd, Corps of Engineers, of lines from the Illinois River, terminating on the Mississippi at the north of the Marais d'Osier, at Watertown, and at Rock Island. A survey of the Illinois and Michigan Canal with a view to its enlargement was also made.

On account of the labor involved in the preparation of the estimates, maps, &c., the reports on both surveys were not completed in time for the action of the last Congress, as required in the act. The estimates, however, were transmitted to Congress in anticipation of the reports, and printed in Senate Ex. Doc. No. 78, Forty-seventh Congress, second session.

The reports in question are now submitted in Appendix G G 4 of this report.

Amount appropriated by act passed August 2, 1882	$30,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	19,916 21
July 1, 1883, amount available	10,083 79

(See Appendix G G 4.)

IMPROVEMENT OF THE HARBORS AT MICHIGAN CITY AND NEW BUFFALO, LAKE MICHIGAN.

Officer in charge, Maj. Jared A. Smith, Corps of Engineers.

1. *Harbor at Michigan City, Indiana.—Outer Harbor.*—In the autumn of 1882, 150 linear feet of pier was constructed east of entrance; the design is the same as that of breakwater.

Timber and iron have been purchased, and also a portion of the stone to extend the same pier 150 feet farther.

Numerous repairs have been required and made upon the superstructure of the breakwater, and some dredging has been necessary to maintain a sufficient depth of water at the entrance to the inner harbor.

The improvements thus far are such that all classes of vessels on the lakes can enter the harbor at all times during the season of navigation. Those of the last year have done much towards checking the currents which have made an entrance so hazardous in heavy storms. Although sufficiently deep, it is too narrow and is in great need of improvement in this respect. There is also great need of a refuge and anchorage which the present basin does not afford. Designs have been made for enlarging the outer harbor to remedy these defects.

Owing to the lateness in the season when the last appropriation became available, and to other circumstances, fully explained in the appendix, the breakwater has been left incomplete.

The commerce has kept pace with the improvements, so that Michigan City is among the most important distributing points for lumber on the lakes. The harbor was originally the mouth of a creek, generally obstructed by sand bars. The first regular project for its improvement was begun in 1872.

There has been expended in constructing, repairing, and maintaining the work the sum of $450,565.60.

The amount estimated to complete the work to make a harbor of refuge is $475,000. The estimate is based upon a rapid construction of

the breakwater, and owing to numerous contingencies the expense will be largely increased if the appropriations are small.

The sum of $200,000 is therefore asked for the year ending June 30, 1885.

It is proposed to apply the balance available, together with the appropriation asked for, in completing the breakwater and pushing forward the work in accordance with the plans herein mentioned.

July 1, 1882, amount available		$1,011,50
Amount appropriated by act passed August 2, 1882		60,000 00
		61,011 50
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$35,007 53	
July 1, 1883, outstanding liabilities	6,536 52	
		41,544 05
July 1, 1883, amount available		19,467 45
Amount (estimated) required for completion of existing project		475,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		200,000 00

Inner Harbor.—The improvement has consisted in extending the channel by dredging farther up the creek.

A little more than 700 feet has thus been added to the available portion of the inner harbor, which is now 6,500 feet long, and has somewhat more than 2 miles of good wharf front.

Materials for a new dump-scow have been purchased and the construction of same commenced. All the work has been carried on by hired labor and using the machinery and tools belonging to the improvement.

Loaded vessels of all classes on the lakes can proceed without obstruction to any part of the inner harbor.

The entire amount appropriated for this work has been $85,000, and of this amount there has been expended $75,691.45.

The additional amount estimated to complete the project is $15,000.

July 1, 1882, amount available		$406 06
Amount appropriated by act passed August 2, 1882		20,000 00
		20,406 06
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$9,905 31	
July 1, 1883, outstanding liabilities	1,192 20	
		11,097 51
July 1, 1883, amount available		9,308 55
Amount (estimated) required for completion of existing project		15,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		15,000 00

(See Appendix H H 1.)

2. *Harbor at New Buffalo, Michigan.*—In reply to a resolution of the House of Representatives of February 21, 1882, asking for information as to the condition of the harbor and what appropriations would be necessary to make it available for commercial purposes, a report was submitted to the House and printed as House Ex. Doc. No. 104, containing an estimate of $150,000 as the amount required. (See also Annual Report of this office for 1882, page 2278.)

The river and harbor act of August 2, 1882, appropriates $5,000 for the improvement. This amount being insufficient to produce any material benefit to the harbor, its expenditure has been deferred.

The harbor is used mainly by a few small fishing vessels, and generally has a depth not exceeding 3 feet at the entrance.

There are no commercial statistics of sufficient value to report.

The harbor is in the collection district of Chicago. The nearest port and light-house are at Michigan City, Ind.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount available	5,000 00

(See Appendix H H 2.)

IMPROVEMENT OF HARBORS ON THE EASTERN SHORE OF LAKE MICHIGAN, AND OF GRAND RIVER BELOW GRAND RAPIDS.

Officers in charge, Maj. D. P. Heap, Corps of Engineers, to March 10, 1883, since which time Capt. D. W. Lockwood, Corps of Engineers.

1. *Charlevoix Harbor, Michigan.*—The average width of the original channel of entrance was 75 feet; the depth varied from 2 to 6 feet.

The present project for its improvement, adopted in 1868 and revised in 1875 and 1876, is to dredge a channel 100 or 150 feet wide to a depth of 12 feet, and to protect both sides with close piling; this was modified in 1876 by substituting crib-work for pile piers.

The amount expended to June 30, 1882, was $50,910.83, and resulted in obtaining a channel 90 feet wide and 12 feet deep along its axis.

The amount expended in fiscal year ending June 30, 1883, was $5,223.77, and has resulted in securing an available depth of channel of 12½ feet by dredging, and in constructing 441 linear feet of plank-beam revetment on south side of channel and 153 feet on north side.

The amount that can be profitably expended for the fiscal year ending June 30, 1885, is $40,000, to be applied to pier extension, to completing the north revetment between the piers and Round Lake, and to revetting the channel between Round Lake and Pine Lake.

July 1, 1882, amount available		$89 17
Amount appropriated by act passed August 2, 1882		10,000 00
		10,089 17
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$655 90	
July 1, 1883, outstanding liabilities	4,567 87	
		5,223 77
July 1, 1883, amount available		4,865 40
Amount (estimated) required for completion of existing project		125,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		40,000 00

(See Appendix I I 1.)

2. *Frankfort Harbor, Michigan.*—The natural channel for entrance to this harbor was not more than from 3 to 4 feet deep.

The present project for its improvement, adopted in 1866, was to dredge an outlet through a strip of land separating Lake Aux Becs Scies from Lake Michigan and to build two parallel piers, 200 feet apart, extending from 12-foot soundings in the inner lake to the same depth in Lake Michigan.

The amount expended to June 30, 1882, was $227,483.49, and resulted in obtaining a channel of navigable width and 12½ feet deep.

The amount expended in year ending June 30, 1883, was $10,755,55, and resulted in obtaining a channel 15 feet deep for a width of 60 feet, and in placing modified superstructure on 100 feet of south pier at outer end. A crib 50 by 30 by 18½ feet was sunk in extension of south pier on June 30.

The amount that can be profitably expended during the fiscal year

ending June 30, 1885, is $50,000, to be applied to pier extension and in placing modified superstructure on crib sunk under a contract now in force. Both revetments also need repairs, and some dredging will have to be done.

July 1, 1882, amount available		$1,176 36
Amount appropriated by act passed August 2, 1882		15,000 00
		16,176 36
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$6,644 97	
July 1, 1883, outstanding liabilities	4,110 58	
		10,755 55
July 1, 1883, amount available		5,420 81
Amount (estimated) required for completion of existing project		85,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		50,000 00

(See Appendix I I 2.)

3. *Harbor of Refuge at Portage Lake, Michigan.*—No natural channel existed prior to the beginning of the improvement.

The project for improvement adopted in 1879 was to make this a harbor of refuge, with a navigable channel 300 feet wide and not less than 18 feet deep.

The amount expended to June 30, 1882, was $29,684.16, and resulted in securing a channel 50 feet wide and not less than 6 feet deep, and in extending the pile-piers to a depth of 12 feet in Lake Michigan.

The amount expended during the fiscal year ending June 30, 1883, was $15,202.01, and resulted in extending the inner end of the north pier 550 feet; in building and sinking a 50 by 24 by 16½ foot crib at outer end of the north pier, and in dredging in the channel to give a channel 50 feet wide and 9½ feet deep.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $140,000, to be applied to pier extension and dredging in furtherance of the approved project.

July 1, 1882, amount available		$315 84
Amount appropriated by act passed August 2, 1882		25,000 00
		25,315 84
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$10,846 88	
July 1, 1883, outstanding liabilities	4,355 13	
		15,202 01
July 1, 1883, amount available		10,113 83
Amount than can be profitably expended in fiscal year ending June 30, 1885		140,000 00

(See Appendix I I 3.)

4. *Manistee Harbor, Michigan.*—A narrow channel not more than 8 feet deep was obtained at this harbor by the slab piers built by local enterprise.

The present project for its improvement adopted in 1866, and modified in 1870–'74, was to afford a channel of entrance of navigable width not less than 12 feet deep.

The amount expended to June 30, 1882, was $199,416.54, and has resulted in securing a channel 170 feet wide, with a depth of not less than 9 feet at its shoalest part.

The amount expended during the year ending June 30, 1883, was $4,272.73, which was applied to the completion of crib at outer end of south pier and the three cribs at outer end of north pier.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $50,000, which it is proposed to apply in extending piers and in dredging.

July 1, 1882, amount available		$3,583 46
Amount appropriated by act passed August 2, 1882		15,000 00
		18,583 46
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,322 32	
July 1, 1883, outstanding liabilities	950 41	
		4,272 73
July 1, 1883, amount available		14,310 73
Amount that can be profitably expended in fiscal year ending June 30, 1885		50,000 00

(See Appendix I I 4.)

5. *Ludington Harbor, Michigan.*—The channel made by local enterprise at this harbor was narrow and not more than 7 feet deep.

The present project for its improvement, adopted in 1867, was to afford a channel of entrance of navigable width and not less than 12 feet deep.

The amount expended to June 30, 1882, was $212,921.16, and has resulted in securing a channel about 200 feet wide with a minimum depth of 10½ along its axis.

The amount expended during the fiscal year ending June 30, 1883, was $7,180.79, and has resulted in the completion of repairs to crib damaged May 23, 1882, and in the construction of 100 feet of superstructure over the cribs sunk in 1880 and 1881, and in dredging for the temporary relief of the harbor.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $40,000, which it is proposed to apply in pier extension and dredging.

July 1, 1882, amount available		$1,263 84
Amount appropriated by act passed August 2, 1882		12,000 00
		13,263 84
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$6,301 56	
July 1, 1883, outstanding liabilities	879 23	
		7,180 79
July 1, 1883, amount available		6,083 05
Amount that can be profitably expended in fiscal year ending June 30, 1885		40,000 00

(See Appendix I I 5.)

6. *Pentwater Harbor, Michigan.*—The original channel of entrance was narrow and not more than 4 feet deep in its shoalest part.

The present project for its improvement, adopted in 1866, was to afford a channel of navigable width and not less than 12 feet deep.

The amount expended to June 30, 1882, was $182,769.77, and resulted in obtaining a channel of navigable width and available depth of 12 feet.

The amount expended during the fiscal year ending June 30, 1883, was $3,199.76, and resulted in placing modified superstructure on one 50-foot crib at end of north pier.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $40,000, to be applied to renewing the revetments on both sides of the channel above the water-line and refilling them to stop leakage of sand, in dredging, and in pier extension.

July 1, 1882, amount available	$50 23
Amount appropriated by act passed August 2, 1882	10,000 00
	10,050 23
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,199 76
July 1, 1883, amount available	6,850 47
Amount that can be profitably expended in fiscal year ending June 30, 1885.	40,000 00

(See Appendix I I 6.)

7. *White River Harbor, Michigan.*—The old channel was narrow, crooked, and too shoal to accommodate any but very small vessels.

The present project for its improvement, adopted in 1866, was to afford a channel of navigable width not less than 12 feet deep.

The amount expended to June 30, 1882, was $215,444.45, and resulted in obtaining a channel of entrance of varying width, and an available depth of 8 feet, and in nearly arresting the shoaling of the channel of entrance by sand drift through and over the piers and revetments.

The amount expended during the fiscal year ending June 30, 1883, was $4,456.39. This has been expended in repairs and in placing superstructure on the three outer cribs of the south pier. This work is now in progress.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $50,000, which it is proposed to apply to renewing the revetments on both sides of the channel above the water-line, also the superstructure of both piers, where necessary, and in pier extension.

July 1, 1882, amount available		$105 55
Amount appropriated by act passed August 2, 1882		12,000 00
		12,105 55
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,906 87	
July 1, 1883, outstanding liabilities	549 52	
		4,456 39
July 1, 1883, amount available		7,649 16
Amount that can be profitably expended in fiscal year ending June 30, 1885.		50,000 00

(See Appendix I I 7.)

8. *Muskegon Harbor, Michigan.*—The original channel was irregularly defined by slab piers, which gave fair access, but a bar just at the end of the piers, on which there was only 7 feet of water, obstructed navigation.

The present project for improvement, adopted in 1866, was to obtain a channel of entrance of navigable width, and to extend the piers over the bar to 17 feet soundings.

The amount expended to June 30, 1882, was $16[illegible],608.87, and has resulted in obtaining a channel 186 feet wide, with an available depth of 14 feet, for nearly the entire width; a channel 300 feet wide between the south pier and the detached section of north pier; in securing the channel of entrance from sand-drift and in keeping the piers in repair.

The amount expended during the fiscal year ending June 30, 1883, was $23,406 95, and resulted in repairing a break at end of south pier, caused by a colliding vessel, and in renewing the superstructure of 115 feet of pile-pier.

The timber and iron for new superstructure over 100 feet of pile-pier,

in addition to the above, and a square 32-foot crib, have also been purchased, and 75 piles for closing the gap between the sections of the north pier. Three cribs 50 by 30 by 18½ feet are ready for sinking.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $100,000, to be applied to extending the south pier, making the necessary repairs to both piers, and in dredging if necessary.

July 1, 1882, amount available		$6,891 13
Amount appropriated by act passed August 2, 1882		25,000 00
		31,891 13
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$13,157 27	
July 1, 1883, outstanding liabilities	10,249 68	
		23,406 95
July 1, 1883, amount available		8,484 18
Amount that can be profitably expended in fiscal year ending June 30, 1885		100,000 00

(See Appendix I I 8.)

9. *Grand Haven Harbor, Michigan.*—The natural outlet was wide but shoal, the water being only 9 feet deep in the best course.

The present project for its improvement, adopted in 1866, was to obtain a channel of navigable width with a minimum depth of 18 feet.

The amount expended to June 30, 1882, was $360,086.97, and has resulted in obtaining a channel 400 feet wide, with a depth of 16 feet available for navigation, and in partially securing the inner harbor from sand encroachment.

The amount expended during the fiscal year ending June 30, 1883, was $66,900.43, and resulted in placing two cribs 50 by 30 by 18½ feet on pile foundation in extension of south pier; in extensive repairs to the south revetment; in building of new sand fences, and replacing superstructure on pile foundation in south pier. Besides, a large amount of timber and iron have been purchased for repairs to south pier.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $150,000, to be applied to pier extension and repairs to piers and sand fences.

July 1, 1882, amount available		$41,779 18
Amount appropriated by act passed August 2, 1882		40,000 00
		81,779 18
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$62,455 29	
July 1, 1883, outstanding liabilities	4,445 14	
		66,900 43
July 1, 1883, amount available		14,878 75
Amount (estimated) required for completion of existing project		260,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		150,000 00

(See Appendix I I 9.)

10. *Grand River, Michigan.*—The portions of channel below Grand Rapids intended to be improved have less than 4 feet water at low stage.

The original adopted project, 1881, is to give relief to light navigation by securing 4 feet depth of water over shoals.

The amount expended to June 30, 1882, was $7,636.70, and resulted in securing a narrow channel of the requisite depth through a shoal

below Grand Rapids, in the vicinity of the Lake Shore and Michigan Southern Railroad Bridge.

The amount expended during the fiscal year ending June 30, 1883, was $6,898.08, and resulted in the removal of 6,171.89 cubic yards of bowlders, &c., and 1,035 cubic yards of clay, for the purpose obtaining of a low-water depth of 4 feet above the Lake Shore and Michigan Southern Railroad Bridge.

No appropriation is asked for the year ending June 30, 1885.

July 1, 1882, amount available		$2,363 30
Amount appropriated by act passed August 2, 1882		15,000 00
		17,363 30
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$5,881 54	
July 1, 1883, outstanding liabilities	1,016 54	
		6,898 08
July 1, 1883, amount available		10,465 22

(See Appendix I I 10.)

11. *Black Lake Harbor, Michigan.*—The channel made by the "Harbor Board of the city of Holland" was narrow, irregular, and only 5½ feet deep. The project for its improvement, adopted in 1866 and modified in 1873, was to obtain a channel of entrance of navigable width, and not less than 12 feet deep.

The amount expended to June 30, 1882, was $229,478.56, and resulted in obtaining a navigable channel with a middle depth of 9 feet, and in securing the channel of entrance from sand-drift over and through the piers.

The amount expended during the fiscal year ending June 30, 1883, was $1,227.80, for the purchase of material for renewing superstructure of north pier in part.

Extensive repairs to north pier are now in progress.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $20,000, to be applied to renewing superstructure of south pier, and in building up pier-heads of both piers that have settled badly.

Some dredging will probably be required.

July 1, 1882, amount available		$136 75
Amount appropriated by act passed August 2, 1882		10,000 00
		10,136 75
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		1,227 80
July 1, 1883, amount available		8,908 95
Amount that can be profitably expended in fiscal year ending June 30, 1885.		20,000 00

(See Appendix I I 11.)

12. *Saugatuck Harbor, Michigan.*—The channel was originally made by local enterprise, was narrow, and not more than 7 feet deep in the best water.

The project for its improvement, adopted in 1869, was to obtain a channel of entrance of navigable width, with a minimum depth of 10 feet.

The amount expended to June 30, 1882, was $115,277.75, and resulted in obtaining a navigable channel 10 feet deep below the lower bend of the river, and in partially constructing a revetment to preserve this channel.

The amount expended during the fiscal year ending June 30, 1883, was $1,112.78. This was for repairs to south pier.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $12,000, to be applied to overhauling and refilling the south pier and revetment and in dredging.

July 1, 1882, amount available		$161 25
Amount appropriated by act passed August 2, 1882		8,000 00
		8,161 25
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$1,005 28	
July 1, 1883, outstanding liabilities	107 50	
		1,112 78
July 1, 1883, amount available		7,048 47
Amount that can be profitably expended in fiscal year ending June 30, 1885.		12,000 00

(See Appendix I I 12.)

13. *South Haven Harbor, Michigan.*—The channel was originally made by private enterprise; was narrow, and not more than 7 feet deep in the deepest place.

The present project for its improvement, adopted in 1866, and modified in 1879, was to obtain a channel of entrance of navigable width not less than 14 feet deep.

The amount expended to June 30, 1882, was $157,566.35, and resulted in obtaining a navigable channel with an available depth of water of 14 feet inside the outer bar.

The amount expended during the fiscal year ending June 30, 1883, was $8,248.75, and resulted in a quite general overhauling and refilling of the piers and revetments; in building 592 feet of sand fences, and 85 feet of plank beam revetment. A cut of 14 feet deep has been dredged up to the railroad bridge and another between the piers, in all 17,449 cubic yards having been removed.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $30,000, to be applied to pier extension in accordance with present project.

July 1, 1882, amount available		$1,933 65
Amount appropriated by act passed August 2, 1882		10,000 00
		11,933 65
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$6,037 06	
July 1, 1883, outstanding liabilities	2,211 69	
		8,248 75
July 1, 1883, amount available		3,684 90
Amount (estimated) required for completion of existing project		90,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		30,000 00

(See Appendix I I 13.)

14. *Saint Joseph Harbor, Michigan.*—The natural channel was about 250 feet wide and 12 feet deep at the entrance, shoaling to 9 feet in the river above.

The present project for its improvement, adopted in 1866 and 1874, was to obtain a channel of entrance of navigable width and not less than 16 feet deep.

The amount expended to June 30, 1882, was $297,705.78 (which includes the construction of a wing-dam at the mouth of the Paw Paw River) and resulted in obtaining a channel 240 feet wide, with an avail-

able depth of 14 feet between the piers and of 12 feet in the old channel of the South Basin, in building a plank beam revetment along the north bank of the Benton Harbor Canal, in dredging this canal to 100 feet in width and 12 feet in depth, and in making a resurvey of the harbor.

The amount expended in fiscal year, June 30, 1883, was $3,802.46, and resulted in extensive repairs to south pier; placing superstructure on the end crib of north pier, and building 1,460 feet of sand fence.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $60,000, to be applied to rebuilding the entire north revetment and extending it up-stream, in widening and deepening the canal leading up to Benton Harbor, and in dredging about the lower railroad bridge.

July 1, 1882, amount available		$407 22
Amount appropriated by act passed August 2, 1882		12,000 00
		12,407 22
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		3,802 46
July 1, 1883, amount available		8,604 76
Amount that can be profitably expended in fiscal year ending June 30, 1885		60,000 00

(See Appendix I I 14.)

IMPROVEMENT OF SAINT MARY'S RIVER; ENLARGEMENT OF AND OPERATING SAINT MARY'S FALLS CANAL—IMPROVEMENT OF CERTAIN HARBORS ON LAKE HURON AND OF SAGINAW RIVER—CONSTRUCTION OF HARBOR OF REFUGE ON LAKE HURON AND OF ICE-HARBOR AT BELLE RIVER—REPAIR AND PRESERVATION OF SAINT CLAIR FLATS CANAL—IMPROVEMENT OF DETROIT RIVER.

Officer in charge, Maj. F. U. Farquhar, Corps of Engineers, until his death, July 3, 1883; present officer in charge, Lieut. Col. O. M. Poe, Corps of Engineers.

1. *Hay Lake Channel, Saint Mary's River, Michigan.*—The channel of the river by this route is only available for boats of light draught. The original project was to obtain a channel 200 feet wide and of a depth sufficient for vessels that would pass through the new lock.

The amount expended to June 30, 1883, is $13,722.41, and has been applied to repair of crane-boat and tug and construction and fitting out of quarter boat, to digging test pits to determine the character of dredging, and to surveys with a view of estimating the amount of dredging; 2,200 cubic yards of material have been removed from an area of 3,000 square feet. The work was done by contract.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $500,000, to be applied to continuing excavation, surveys, &c.

Received from sale of fuel		$39 38
Amount appropriated by act passed August 2, 1882		200,000 00
		200,039 38
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$10,273 38	
July 1, 1883, outstanding liabilities	3,449 03	
		13,722 41
July 1, 1883, amount available		186,316 97

Amount (estimated) required for completion of existing project	$1,927,292 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	500,000 00

(See Appendix J J 1.)

2. *Saint Mary's Falls Canal, Michigan.*—A depth of about 11 feet 6 inches could be carried through the channel between lakes Superior and Huron when the Government began its improvement in 1870. The canal had a depth of 12 feet at the ordinary stage. Its sides were paved with rough stone. Its width at bottom was 62 feet and at the water surface 100 feet. The originally adopted project was to deepen the canal to admit a draught of vessels, at ordinary stages, of 16 feet; to widen the canal and substitute nearly vertical timber crib revetment on the sides for the rough stone slopes; to construct a new lock with a single lift of 18 feet, and a capacity of 515 by 80 feet, for a draught of 17 feet; to build a branch canal from this new lock to the river below and the enlarged canal above; to excavate a large basin for supplying lockage water at the head of the old and new locks, and to construct a guard-gate at the head of the former. The straightening of the south bank of the canal at its head, and constructing a new, larger, and improved movable dam, to serve the purpose of guard-gates, near the head, were the two most important additions to the original project.

The amount expended on this improvement up to June 30, 1882, was $2,330,945.34.

Vessels drawing 16 feet could pass through the canal and new lock, and vessels not drawing over about 13 feet 8 inches could pass from Lake Superior to Lake Huron.

The original project for the improvement of the river was adopted in 1879, and consisted in deepening the present navigable channel to 16 feet at every place except East Neebish, which it was believed the Canadian Government would improve.

The amount expended during the fiscal year ending June 30, 1883, is $70,929.50. A channel 150 feet wide and 17 feet deep has been made through East Neebish, and a cut in Lake George now gives 17 feet depth through that lake.

July 1, 1882, amount available		$74,054 66
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$70,597 19	
July 1, 1883, outstanding liabilities	332 31	
		70,929 50
July 1, 1883, amount available		3,125 16

(See Appendix J J 2.)

3. *Operating Saint Mary's Falls Canal, Michigan.*—During the past year the canal was open for navigation 216 days. It was closed December 3, 1882, and opened May 2, 1883.

Four thousand one hundred and sixty-three vessels and rafts, having a registered tonnage of 2,130,181 tons and carrying 28,401 passengers and 1,874,404 tons of freight, passed through. The staple articles which were carried by these vessels were 464,320 tons of coal, 25,937 tons of copper, 804,766 tons of iron ore, 78,909 tons of pig and manufactured iron, 5,068,417 bushels of grain, 427,866 barrels of flour, 107,835 barrels of salt, and 74,734,000 feet B. M. lumber.

The expense of operating and care of the canal during the year was $35,509.70. The estimated amount required for the fiscal year ending June 30, 1884, is $35,000.

The river and harbor act of March 3, 1881, provides that hereafter, for the purpose of operating and care of the canal, the Secretary of War

is authorized to draw his requisition on the Secretary of the Treasury from time to time.

(See Appendix J. J 3.)

4. *Harbor at Cheboygan, Michigan.*—The channel of entrance at this harbor was originally narrow, with not more than 6½ to 7 feet depth in the shoalest part. The present project for its improvement was adopted in 1871, the object being to secure a channel from the mouth of the river 200 feet wide and not less than 14 feet deep.

The amount expended to June 30, 1882, was $102,730.58, and resulted in obtaining a channel of entrance 15 feet deep and 50 feet wide, except for a short section at each end, where the width was only 25 feet, and in placing a 40-foot square crib in 16-foot soundings in line with northern pier.

The amount expended during the fiscal year ending June 30, 1883, is $10,151.40, which has resulted in obtaining a depth of 15 feet in the winding-basin opposite the steamboat landing and a channel of entrance 15 feet deep, with a width of 90 feet at the outer end and 200 feet near the steamboat landing.

A revised estimate (submitted in last annual report) for deepening the above channel of entrance to 15 feet places the cost of completion at $50,000.

July 1, 1882, amount available		$269 42
Received from sale of fuel		3 00
Amount appropriated by act passed August 2, 1882		10,000 00
		10,272 42
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$10,031 40	
July 1, 1883, outstanding liabilities	120 00	
		10,151 40
July 1, 1883, amount available		121 02
Amount (estimated) required for completion of existing project		50,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		26,000 00

(See Appendix J J 4.)

5. *Harbor at Thunder Bay, Michigan.*—The depth of the original channel at this harbor varied from time to time from 4 feet to 7 feet at the shoalest part. It was, however, in 1869 deepened by private enterprise to 11 feet.

The project for its improvement was adopted in 1876, the object being to afford a channel of entrance of navigable width and a depth of not less than 13 feet. This was modified in 1881, increasing the depth to 14 feet.

The amount expended to June 30, 1882, was $4,559.73, and resulted in securing a channel 12 feet deep.

The amount expended during the fiscal year ending June 30, 1883, is $4,441.94, and has resulted in the removal of 16,899 cubic yards of material from the channel.

July 1, 1882, amount available		$109 52
Amount appropriated by act passed August 2, 1882		15,000 00
		15,109 52
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$2,844 74	
July 1, 1883, outstanding liabilities	1,597 20	
		4,441 94
July 1, 1883, amount available		10,667 58

(See Appendix J J 5.)

6. *Harbor at Au Sable, Michigan.*—The present project for the improvement of the harbor was adopted in 1866, and modified in 1879, the object being to afford a channel of not less than 10 feet in depth and 100 feet in width.

The amount expended during the fiscal year ending June 30, 1883, was $160.40. The cost of the work thus far has been about $103,000.

The officer in charge submits a project for extending the piers on each side of the channel, for the improvement of the river inside, and for dredging the channel between the extended piers to a depth of 12 feet, the estimated cost of which is $32,121.69, the whole amount of which can be profitably expended in one season.

July 1, 1882, amount available	$60 95
Amount appropriated by act passed August 2, 1882	5,000 00
	5,060 95
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	160 40
July 1, 1883, amount available	4,900 55
Amount (estimated) required for completion of proposed project	32,121 69
Amount that can be profitably expended in fiscal year ending June 30, 1885	32,200 00

(See Appendix J J 6.)

7. *Saginaw River, Michigan.*—The report of a Board of Engineers, appended to this report, gives in detail the history of the work. Its recommendations having been approved now constitute the project for the improvement. They are:

1st. A channel 14 feet deep across the bar at the mouth of the river.

2d. Removal of the shoal immediately above the draw of the Third Street Bridge at Bay City to a depth of 14 feet, to enable vessels to pass through the draw, and of other shoals in front of the city to the same depth.

3d. Twelve feet of water and a channel at least 200 feet wide from Bay City to the head of navigation; this channel to be so made as not to destroy, interfere with, or render difficult of access the store booms on each side of the river.

To accomplish this the Board recommended—

1st. That all snags and logs be taken up and all store booms that project into the channel be removed.

2d. That the obstructions between the junction of the Tittibawassee and Shiawassee rivers and the Portsmouth Bridge at Bay City be removed by dredging a channel 12 feet deep and 200 feet wide.

3d. That the shoals in front of Bay City, and immediately above the draw of the Third Street Bridge, be removed by dredging a channel 14 feet deep and 200 feet wide.

4th. That dredging be done annually to afford relief after the spring freshets.

5th. That two cross-dams be built, one behind the revetment at Carrollton, and the other across the Oneida Channel.

6th. That the channel across the bar at the mouth of the river be dredged to a depth of 14 feet and width of 200 feet at the bottom.

The Board estimated the total cost of this work at $446,000, of which $200,000 was for dredging above the bar at the mouth of the river. Experience has shown that the estimate for this portion of the work is too low, and that it will cost 50 per cent. more, or $300,000. This will increase the estimate for the whole work to $546,000.

By act of August 2, 1882, the sum of $125,000 was appropriated, and work to this amount, in furtherance of the project, is now going on.

The work can be carried on at the several points at the same time, in consequence of which a very large force can be employed.

July 1, 1882, amount available		$2,517 23
Received from sale of fuel		10 50
Amount appropriated by act passed August 2, 1882		125,000 00
		127,527 73
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$4,030 35	
July 1, 1883, outstanding liabilities	7,203 19	
		11,233 54
July 1, 1883, amount available		116,294 19
Amount (estimated) required for completion of existing project		421,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		200,000 00

(See Appendix J J 7.)

8. *Harbor of Refuge, Sand Beach, Lake Huron, Michigan.*—The present project for the construction of this harbor was adopted in 1873. Its object is to furnish a harbor of refuge to the vessels engaged in the commerce of the northern and northwestern lakes when caught by heavy weather near the dangerous Point Aux Barques. Before the year 1876, whenever vessels were so caught they were compelled to run a distance of 60 miles and take refuge in the Saint Clair River.

The amount expended to June 30, 1882, was $776,618.86, and has resulted in completing 5,205 feet of breakwater and partially completing 845 feet.

The amount expended during the fiscal year ending June 30, 1883, is $76,993.81, and has resulted in the construction of 520 feet of breakwater.

The amount required to complete the work upon the present plan is estimated as follows:

Superstructure of lake arm		$60,000 00
Superstructure of south arm		40,000 00
Dredging and repairs		75,000 00
Total		175,000 00
July 1, 1882, amount available		48,381 14
Received from sale of fuel		174 37
Amount appropriated by act passed August 2, 1882		75,000 00
		123,555 51
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$69,034 76	
July 1, 1883, outstanding liabilities	7,959 05	
		76,993 81
July 1, 1883, amount available		46,561 70
Amount (estimated) required for completion of existing project		175,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		125,000 00

(See Appendix J J 8.)

9. *Ice Harbor of Refuge, Belle River, Michigan.*—Belle River is about 140 feet wide and in the lower reaches was originally from 7 to 9 feet deep. The project for improvement was adopted in 1880, the object being to create a shelter for vessels during winter by securing a channel 50 feet wide, with a depth of 13 feet up to the first bridge, and a depth of 12 feet from that point up to the second bridge. The amount expended

to June 3, 1882, was $7,002.78, and resulted in obtaining a cut 50 feet wide and 13 feet deep up to the first bridge.

The amount expended during the fiscal year ending June 30, 1883 is $5,085.04, and has resulted in opening one cut 12 feet deep between the first and second bridges, and a second cut of same depth for about one-half that distance.

July 1, 1882, amount available		$180 67
Received from sale of fuel		25 13
Amount appropriated by act passed August 2, 1882		5,000 00
		5,205 80
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		5,085 04
July 1, 1883, amount available		120,76
Amount (estimated) required for completion of existing project		2,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		2,000 00

(See Appendix J J 9.)

10. *Operating and care of Saint Clair Flats Ship-Canal, Michigan.*—This canal was projected in 1866, the object being to afford a straight channel 13 feet deep and 300 feet wide across Saint Clair Flats. This project was modified in 1873 so as to secure a depth of 16 feet for a width of 100 feet on each side of the axis of the canal. Up to the 30th June, 1883, the sum of $606,885.09 had been expended upon this work.

The cost of operating the canal for the fiscal year 1882–'83, and for making the current small repairs, was $5,668.87. The dikes on either side of the canal are formed of the material excavated from the channel, this material (fine sand, with some loam) being deposited in large crib-pockets made of timber. These cribs rest upon the original bottom of the shoal. To prevent the caving of the sides left after the dredging of the channel a single row of sheet-piling was used, and the lake sides of the dikes were protected by shorter sheet-piling. All of this superstructure above water is now in a natural state of decay, and the time has come for taking measures for general repairs and renewals. The single rows of sheet-piling have been found insufficient, and require complete reinforcing. A project for doing what is now necessary has been submitted by the officer in charge, the estimated cost being $132,908, all of which could be profitably expended in one season.

July 1, 1882, amount available			$1,173 38
Amount allotted for operating and care			5,000 00
			6,173 38
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$5,110 37		
July 1, 1883, outstanding liabilities	558 50		
		5,668 87	
July 1, 1883, amount available			504 51
Amount (estimated) required for fiscal year 1883–'84			11,500 00

(See Appendix J J 10.)

11, *Clinton River, Michigan.*—The channel of entrance to this river was in 1870 only 3½ feet deep in the shoalest place, while the depth in the river above was 10 feet.

The project for improvement was adopted in 1870 and modified in 1880, the object being to obtain a channel of entrance 60 feet wide and 8 feet deep.

The amount expended to June 30, 1882, was $7,497.16, and resulted in obtaining a channel 8 feet deep, varying in width from 20 to 60 feet.

The amount expended during the fiscal year ending June 30, 1883, is $6,119.93, and has resulted in opening a channel 60 feet wide and 9 feet deep at the entrance, and in protecting the north bank with brush-mattresses; also in constructing a pile crib 40 feet square in Lake Saint Clair, and partly filling it with brush and stone. The crib is at the end of the line of pile clusters (which serve as ice-breakers), and in 10 feet of water.

July 1, 1882, amount available		$502 84
Received from sale of fuel		39 38
Amount appropriated by act passed August 2, 1882		6,000 00
		6,542 22
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$5,969 93	
July 1, 1883, outstanding liabilities	150 00	
		6,119 93
July 1, 1883, amount available		422 29
Amount (estimated) required for completion of existing project		20,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		10,000 00

(See Appendix J J 11.)

12. *Detroit River at Lime-Kiln Crossing.*—The original condition of the navigable channel at this point was such that vessels drawing 13 feet of water could often barely pass. The original project for its improvement was adopted in 1874, its object being to make a cut along the main channel, through the limestone ridge that extends across the river, 300 feet wide, with a depth of 20 feet in ordinary low-water stages.

The amount expended to June 30, 1882, was $273,983.73. No material benefit will result from the work until it is completed. The amount expended during the fiscal year ending June 30, 1883, is $53,511.83, and has resulted in the removal of 6,534 cubic yards of rock.

A report from the officer in charge, Major Farquhar, was submitted in February last to the House of Representatives for the information of the Committee on Commerce (see House Ex. Doc. No. 80, and Appendix J J of this report), containing a modification of this work by substituting a straight channel for the curved channel originally projected. The cost of this modification increases the cost of completion of the work, which is now estimated at $227,700.

This increase still makes the cost of completion less than one-half the original estimate which was before Congress when the first appropriation was made.

July 1, 1882, amount available		$1,016 27
Received from sale of fuel		13 12
Amount appropriated by act passed August 2, 1882		60,000 00
		61,029 39
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$36,991 58	
July 1, 1883, outstanding liabilities	16,520 25	
		53,511 83
July 1, 1883, amount available		7,517 56
Amount (estimated) required for completion of existing project		227,700 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		227,700 00

(See Appendix J J 12.)

13. *Removing sunken vessels obstructing or endangering navigation.*—The wreck of the steamer Nile has been removed from Detroit River, in front of the city of Detroit. The work was begun on the 10th of July, 1882, and completed on the 25th of the same month at a cost of $1,536.92.

No other occasion arose for work of this kind, nor is any known to now exist.

(See Appendix J J 13.)

IMPROVEMENT OF HARBORS ON LAKE ERIE WEST OF ASHTABULA, OHIO— IMPROVEMENT OF SANDUSKY RIVER.

Officers in charge, Maj. John M. Wilson, Corps of Engineers, until October 24, 1882, with Capt. M. B. Adams, Corps of Engineers, under his immediate orders; since which time Maj. L. Cooper Overman, Corps of Engineers.

1. *Monroe Harbor, Michigan.*—The original project for the improvement of this harbor was adopted in 1835, when Monroe was a town of considerable importance, and when the navigable waters of the river Raisin were separated from the waters of Lake Erie by extensive shoals. It provided for cutting a canal between the river and the lake 4,000 feet long and 100 feet wide, through the peninsula called "River Raisin Point," and protecting the entrance into the lake by parallel piers running out to a depth of 10 feet, the object being to afford a channel of entrance of navigable width, with a depth of 10 feet.

Work was commenced in 1835, and has been continued from time to time since that date.

At the close of the present fiscal year there was a good channel, with a least depth of 10 feet, up to a point below Monroe, which is deemed sufficient for the present commerce of the port. During the fiscal year ending June 30, 1883, repairs have been made to the United States Canal, and minor repairs to piers.

The total amount appropriated for this harbor has been $213,515.27, which has resulted in securing a navigable channel, with a least depth of 10 feet, up to a point just below the docks at Monroe, where rock bottom occurs.

If this harbor is to be kept up, there is need of extensive repairs to piers and revetment, in order to prevent their ultimate destruction or more expensive renewals in later years. These are estimated to cost $20,000.

The present commerce of Monroe is not sufficient, in the opinion of the officer in charge, to justify such a large expenditure. Hence he considers a small annual appropriation for repairs sufficient until an increase of commerce demands the extensive renewals.

July 1, 1882, amount available	$16 45
Amount appropriated by act passed August 2, 1882	1,000 00
	1,016 45
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	522 06
July 1, 1883, amount available	494 39
Amount (estimated) required for completion of existing project	20,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	2,000 00

(See Appendix K K 1.)

2. *Toledo Harbor, Ohio.*—When operations were commenced at this harbor, in 1866, the channel through the bay was narrow and intricate, presenting a depth of only 11 feet..

The original project provided for cutting a channel 200 feet wide and 12 feet deep through Maumee Bay, and this was amended from time to time, until the present project provides for a channel 200 feet wide at bottom and 16 feet deep at low water between the city of Toledo and deep water in Lake Erie.

In 1868 there was a channel 100 feet wide and 12 feet deep; in 1875 the depth had been increased to 14 feet, and at the close of the fiscal year ending June 30, 1883, there was a good channel 200 feet wide at bottom on the ranges, and from 260 to 350 feet wide at the angles, with a depth of from 15 to 17 feet at low water, between Toledo and deep water in the lakes.

The total amount appropriated for this harbor since 1866 to close of fiscal year ending June 30, 1883, has been $684,700, of which sum $640,972.27 has been expended. This expenditure has resulted in obtaining a good 15½-foot channel where before there was a narrow, intricate channel, with but 11 feet for vessels.

During the fiscal year the sum of $28,941.44 has been expended in maintaining the channel and in deepening and widening same at various places by the removal of 265,415 cubic yards of mud, clay, sand, &c. Operations will be continued during the present season until the present contracts are completed, which will require the removal of 78,475 cubic yards additional.

The removal of the wreck of the scow Wellhouse was finally completed July 10, 1882, at a cost of $1,802.95. The sum of $80,000 is required to complete the existing project, the whole of which can be expended during the period ending June 30, 1885, in deepening and widening the channel between Toledo and 16 feet of water in Lake Erie; after which an annual expenditure of about $30,000 will be needed to maintain the dredged channel through the open bay.

July 1, 1882, amount available		$22,669 17
Amount appropriated by act passed August 2, 1882		50,000 00
		72,669 17
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$28,941 44	
July 1, 1883, outstanding liabilities	908 55	
		29,849 99
July 1, 1883, amount available		42,819 18
Amount (estimated) required for completion of existing project		80,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		80,000 00

(See Appendix K K 2.)

3. *Port Clinton Harbor, Ohio.*—The first survey of the harbor under the General Government was made in 1867, but no action was taken upon it. In 1870 a new survey was made, which showed the channel at the entrance to be narrow and intricate, with a depth of only 5 feet. The original project provided for cutting a channel 8 feet deep through the outer bar and constructing piers from the shore out to the necessary depth. Efforts were made, without success, during the years 1872, 1873, and 1874, to obtain a channel by dredging only, but the required depth could not be maintained.

The present project, adopted in 1875, provides for a pile revetment, running from the north shore of the Portage River, opposite the town, 967 feet out into the lake in a direction north 57° east; then, inclining towards the north, a pile pier about 1,500 feet long extends to the depth of 10 feet in the lake; parallel to this, and 200 feet from it, an east pier

2,600 feet long to run out from the south shore of the river. It is expected that a full depth of 9 feet can be maintained by confining the waters of the Portage River between these piers.

The total amount appropriated for this harbor to the close of the fiscal year ending June 30, 1883, has been $46,000, of which sum $40,004.83 has been expended. This expenditure has resulted in obtaining a depth of 9 feet from the lake to the town, where there was originally but 5 feet. During the fiscal year there has been expended $829.36, and contracts for extension of west pier and of the east pile revetment were in progress at close of the fiscal year. During this season it is proposed to complete the extension of west pier 150 linear feet, and to extend the east revetment 250 linear feet.

The original estimate for the work was $122,000; a revised estimate, $90,000, of which $46,000 has been appropriated, but the engineer in charge questions the advisability at present of expending the remaining $44,000, as the commerce at present or prospective is not such as to justify such an expenditure. If it is deemed best to continue the improvement as projected, the sum of $20,000 can be expended during the fiscal year ending June 30, 1885.

July 1, 1882, amount available	$824 53
Amount appropriated by act passed August 2, 1882	6,000 00
	6,824 53
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	829 36
July 1, 1883, amount available	5,995 17
Amount (estimated) required for completion of existing project	44,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	20,000 00

(See Appendix K K 3.)

4. *Sandusky City Harbor, Ohio.*—The original survey of this harbor was in 1826, but no appropriation was made until 1844. In the latter year the depth in the channel through the outer bar was 10 feet, and the greatest depth in the bay was about 12 feet. There was an extensive breach in the peninsula which protects the harbor on the west and northwest; the original project provided for closing this breach by cribwork and deepening the channel through the outer bar to 12 feet.

The appropriations of 1844 and 1852 were devoted to closing the breach in the peninsula, but the failure of further appropriations left the work unfinished, and in 1864, when operations were resumed, the old work was found to have been destroyed.

In 1864 a project was submitted for opening a channel 400 feet wide and 12 feet deep through the outer bar; this has been amended from time to time, and at present the project calls for a channel through the outer bar and the bay up to within 50 feet of the line of docks, and then parallel to the docks; the portion through the bar and bay to be 200 feet wide, and that parallel to the docks 100 feet wide, the whole to be 15 feet deep. In 1869 the channel through the outer bar was 240 feet wide and 12 feet deep; in 1872 the depth was increased to 13 feet, and work was commenced upon the channel within the bay; in 1875 there was a channel 100 feet wide through the outer bar, and one 150 feet wide and from 13 to 15 feet deep within the bay up to a point about $1\frac{1}{3}$ miles from the docks at Sandusky City.

At the close of the fiscal year ending June 30, 1882, the sum of $233,878.48 had been expended on this harbor, and there was a channel through the outer bar about 150 feet wide, with a depth of about 14 feet.

and through the bay up to a point 50 feet from line of docks, with a width of 200 feet and depth of about 15 feet. During the fiscal year ending June 30, 1883, the sum of $7,173.51 has been expended; 60,000 cubic yards of mud, clay, sand, &c., have been removed; the channel parallel to line of city docks was excavated for a length of 4,680 feet by 100 feet in width, and least depth of 15 feet, and channel entrance from "Clock Range" to that parallel to line of docks was widened from 200 feet to 1,000 feet, with least depth of 15 feet.

During the present season it is proposed to widen and deepen the channel through "the outer bar" so far as the removal of 10,000 cubic yards will allow.

The sum of $30,000 is required to complete the existing project, the whole of which can be profitably expended during the period ending June 30, 1885, in widening and deepening the channel from deep water in the lake to the docks at Sandusky City.

An increased channel depth of 16 feet at low water has been recommended for this harbor on account of the increased size of vessels navigating the lakes.

The estimated cost of this extra depth is estimated at $61,000 additional, and if this revised project is favorably considered the sum of $30,000 additional (making $60,000 in all) can be profitably expended during the fiscal year ending June 30, 1885.

July 1, 1882, amount available		$1,201 52
Amount appropriated by act passed August 2, 1882		10,000 00
		11,201 52
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$7,173 51	
July 1, 1883, outstanding liabilities	651 42	
		$7,824 93
July 1, 1883, amount available		3,276 59
Amount (estimated) required for completion of existing project		30,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		30,000 00

(See Appendix K K 4.)

5. *Sandusky River, Ohio.*—During the years 1867 and 1872 the sum of $30,000 was expended in opening a navigable channel, with a depth of 8 feet, from Sandusky Bay to Fremont, a distance of 17 miles; since 1872 the cuts then made through the various bars have filled up.

The present project, which was based upon a survey made in August, 1880, provides for opening a channel 100 feet wide and 9 feet deep between the town of Fremont and the depth of 9 feet in Sandusky Bay, at an estimated cost of $44,000.

At the close of the fiscal year ending June 30, 1883, the sum of $21,500 had been appropriated for the project of 1880, of which amount $20,871.53 has been expended, and by the expenditure there was at the close of the season of 1882 a good channel, with least depth of 9 feet, from Fremont (the head of navigation) to the lake.

During the season of 1882 the sum of $3,392.31 was expended, and resulted in the removal of 25,000 cubic yards of sand, mud, and clay from channel in river and through the bar, giving least depth of 9 feet. The balance on hand is too small to attempt any further work this season, but will be held for an emergency or until further appropriations are made.

Up to the present date $51,500 has been appropriated for this river, of which $50,871.53 has been expended. The sum of $22,500 will be

required to complete the existing project, but the advisablity of such is deemed doubtful by the officer in charge.

July 1, 1882, amount available	$20 78
Amount appropriated by act passed August 2, 1882	4,000 00
	4,020 78
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,392 31
July 1, 1883, amount available	628 47
Amount (estimated) required for completion of existing project	22,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	10,000 00

(See Appendix K K 5.)

6. *Huron Harbor, Ohio.*—The present plan for the improvement of this harbor consists of parallel piers, 140 feet apart, running out into the lake; it was adopted in 1826 and modified in 1871, the object being to afford a channel of entrance of navigable width and of not less than 14 feet in depth.

When work was commenced in 1827 there was a bar at the mouth of the river, dry at low water. In 1839 the channel was 130 feet wide and not less than 9½ feet deep; in 1844 this depth was found to have been maintained, but in 1852, as very little work had been done for fourteen years, the piers were in a dilapidated condition and the channel had shoaled. In 1866 there was a depth of 11 feet at the entrance. At the close of the present fiscal year there was a good channel through the outer bar, with a depth of 14 feet, and between the piers, with a depth of from 14 to 18 feet; the superstructure of both piers, except where repaired last season, was in a decayed condition and needed immediate renewal.

The heavy gales of the spring of 1883 and freshets in February, 1883, did considerable damage to the east pier and to the beach, so that a breach was made between inner end of pier and shore. This damage was partially repaired so far as the balance of appropriation on hand would permit. Further and immediate repairs are much needed.

Up to the present date the sum of $106,773.71 has been appropriated for this harbor, of which amount $106,728.08 has been expended.

A good wide channel, with least depth of 14 feet, has been obtained where originally there was a sand-bar, dry at low water.

The estimated cost of renewing the superstructure of the piers is $22,000; $6,000 has been appropriated, and the remaining $16,000 can be expended during the period ending June 30, 1885, in rebuilding superstructure, repairing piers, &c.

July 1, 1882, amount available	$2,231 58
Amount appropriated by act passed August 2, 1882	2,500 00
	4,731 58
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4,685 95
July 1, 1883, amount available	45 63
Amount (estimated) required for completion of existing project	16,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	16,000 00

(See Appendix K K 6.)

7. *Vermillion Harbor, Ohio.*—The original project for this improvement, which was presented in 1826, when the mouth of Vermillion River was closed by a sand-bar, upon which there was a depth of less than 2 feet

water, consisted of parallel piers running out to a depth of 12 feet in the lake from each side of the mouth of the river, in order to secure a depth of 10 feet water; this project has been amended from time to time, and now provides for a depth of 14 feet.

In 1838 there was a channel 50 feet wide and 6 feet deep. No appropriations were made between 1838 and 1866, and in the latter year the piers were found to be dilapidated and the depth at the entrance to be 7 feet.

In 1878 the channel was about 70 feet wide, with a depth of about 12 feet.

During the present fiscal year some repairs were made to the piers, at a cost of $402.61.

At the close of the fiscal year ending June 30, 1883, the piers were in fair condition; the depth in channel was about the same as at the close of the previous fiscal year.

During the present season (1883) it is proposed to make some minor repairs to the piers, and if necessary do some dredging.

The amount appropriated to close of fiscal year ending June 30, 1883, has been $114,942.32, of which sum $112,434.66 has been expended.

The amount estimated for the completion of the proposed project is $14,000, which can be expended during the period ending June 30, 1885, in removing rock, shale, sand, &c., from the channel and repairing the piers; but the engineer in charge is doubtful as to the advisability of such an expenditure.

Amount appropriated by act passed August 2, 1882	$3,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	492 34
July 1, 1883, amount available	2,507 66
Amount (estimated) required for completion of existing project	14,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	14,000 00

(See Appendix K K 7.)

8. *Mouth of Black River, Ohio.*—The present project for the improvement of this harbor consists of parallel piers, 200 feet apart, running out to a depth of 16 feet in the lake; it was adopted in 1828, modified so as to gain increased depth in 1873, and again in 1880, the object being to afford a channel of entrance of navigable width, and not less than 16 feet in depth.

When work was commenced in 1828, there was a depth of only 3 feet at the entrance; in 1839 there was a least depth of 9½ feet.

But one appropriation of $5,000 was made between 1839 and 1865, and in the latter year the piers were found to be in a dilapidated condition, but a narrow channel with a least depth of 7 feet remained near the west pier. In 1871 there was a depth of 12 feet; in 1874 of 14 feet; and at the close of the present fiscal year there is a good wide channel, with a least depth of 16 feet, from the lake up into the river.

Up to the close of the fiscal year ending June 30, 1883, there had been appropriated the sum of $190,138.73, of which $181,011.12 had been expended, with which a channel with least depth of 16 feet has been obtained where originally there was but 3 feet at the entrance.

During the fiscal year ending June 30, 1883, the sum of $821.87 was expended, with which some repairs to piers were made, and a contract is now in execution for removing superstructure to piers, replacing pile protection damaged during the storm of February, 1883, repairing piers,

&c., and it is expected this season to complete this contract, and place piers in good condition.

The sum of $28,000 is required to complete the existing project, all of which can be expended during the period ending June 30, 1885, in renewal of piers and prolonging them.

July 1, 1882, amount available	$2,949 48
Amount appropriated by act passed August 2, 1882	7,000 00
	9,949 48
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	821 87
July 1, 1883, amount available	9,127 61
Amount (estimated) required for completion of existing project	28,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	28,000 00

(See Appendix K K 8.)

9. *Rocky River Pier, Ohio.*—The project for the improvement of this river was adopted in 1871, the object being to afford a channel of entrance 100 feet wide and from 6 to 12 feet deep; it required the construction of a pier 500 feet long and a large amount of excavation.

The pier as projected was constructed, but only a small amount of excavation was done and no further appropriations were made for continuing the work after March 3, 1875.

By the act of June 14, 1880, an appropriation of $4,000 was made for repairs, and during the years 1880 and 1881 the pier was put in good condition.

At the close of the present fiscal year some repairs were necessary, which will be made during the present season.

No further appropriation is asked for.

July 1, 1882, amount available	$1,586 37
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	1 06
July 1, 1883, amount available	1,585 31

(See Appendix K K 9.)

10. *Cleveland Harbor, Ohio.*—The present project for the improvement of the mouth of the Cuyahoga River was adopted in 1825 and has been amended from time to time to gain increased depth; it consists of parallel piers about 200 feet apart, running out to a depth of 16 feet in the lake.

When operations were commenced in 1825, there was a long, low sandbar where the river now empties into Lake Erie, and the entrance was through a narrow, intricate channel, with a depth of about 3 feet. At the close of the fiscal year ending June 30, 1882, there had been expended $354,000, and there was, as the result, a good wide channel at the entrance to the harbor, with a depth of from 17 to 20 feet between the lake and the railroad bridge at the inner end of the piers, with a pile-protection work 620 feet long at the inner end of the west pier, constructed in 1882, to prevent vessels getting on the old sunken pier. During the present fiscal year the sum of $886.02 has been expended in repairs to piers and dredging of material.

The storms of the winter and spring of this year did considerable damage to piers, and their use by vessels to lay up to also destroyed many timbers, all of which had to be repaired during the spring of 1883, at a cost of $726.06. The freshets of February and March, 1883, also caused a bar, with a least depth of 13 feet, to form in the lake

beyond the end of piers and between them near their outer end. This occasioned considerable annoyance to vessels. Dredging to remove the bar was at once undertaken, and was in progress at the close of the fiscal year, when about 4,000 cubic yards had been removed, leaving about 10,000 cubic yards yet to be excavated.

When completed there will be a good channel, as above stated, with least depth of 17 feet, with the piers in good condition.

The new breakwater.—The present project for a harbor of refuge provides for an outer breakwater, starting from the lake shore about 700 feet west of the upper end of the old river bed.

This breakwater runs out, in a direction about due north, a distance of 3,130 feet to a depth of 28 feet water; the angle is then turned and it runs for about 4,000 feet nearly parallel to the shore, in a depth of from 28 to 30 feet water. The entrance to the harbor, on the east side, will be protected, as at present proposed, by extending the east pier, at the mouth of the river, 1,400 feet.

At the close of the fiscal year ending June 30, 1882, $401,374.82 had been expended on the work; 3,978 linear feet of breakwater had been completed, and 700 linear feet additional of crib-work had been sunk in a depth of 28 to 30 feet of water.

During the present fiscal year the sum of $134,350.95 has been expended, and at its close 1,350 linear feet of finished breakwater was completed; 900 linear feet additional of crib-work was sunk, and 700 linear feet of foundation, for further extention of crib-work, was completed. During the present season work will be continued, extending the breakwater, and it is expected that at least 1,600 linear feet additional will be completed, and probably all the cribs required for the lake arm will be sunk in place, and possibly the entire lake arm completed.

During the fiscal year ending June 30, 1885, the sum of $400,000 can be profitably expended in completing the work as proposed by the present revised project.

The original estimate for this work was $1,800,000, but unless some extraordinary and unforeseen contingency arises, it is expected that the entire work, according to the present revised plan, will be completed for less than $1,200,000. The sum of $800,000 has been appropriated, leaving but $400,000 to be appropriated.

When completed, as now projected, the harbor of refuge will be about 1 mile long, and will offer an area for anchorage of 180 acres, the depth in 140 acres of which will be from 17 to 29 feet.

The available balance July 1, 1883, of $250,734.34, already pledged by contracts, will be nearly all expended by the close of the season of 1883.

July 1, 1882, amount available		$213,271 70
Amount appropriated by act passed August 2, 1882		175,000 00
		388,271 70
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$128,661 18	
July 1, 1883, outstanding liabilities	8,876 18	
		137,537 36
July 1, 1883, amount available		250,734 34
Amount (estimated) required for completion of existing project		400,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		400,000 00

(See Appendix K K 10.)

11. *Fairport Harbor, mouth of Grand River, Ohio.*—The present project for the improvement of this harbor consists of parallel piers, 200 feet

apart, running out into the lake. It was adopted in 1825, and has been modified by prolonging the piers from time to time so as to gain increased depth, the object being to afford a channel of entrance of navigable width, and not less than 16 feet in depth. When the work of improvement was commenced, in 1826, the mouth of the river was closed by a sand-bar, 1,200 feet wide, at times so hard and dry that teams could be driven across.

In 1829 the depth in the channel was about 8 feet, and in 1839, when work was suspended, there was a depth of 11 feet, and any vessel then navigating the lakes could enter at any time without danger. In 1865 the piers were found to be seriously dilapidated; in 1870 there was a depth of 12 feet in the channel; in 1879 this depth was increased to 14 feet; in 1881 to 15 feet; and at the close of the present fiscal year there was a good channel between the lake and the river, with a least depth of 16 feet at low water.

During the fiscal year ending June 30, 1883, operations were begun April 10, and were in progress at the close of the fiscal year. It is expected to complete all the work under contract by the middle of September, 1883. The sum of $1,772.24 was expended during the fiscal year, of which $880.73 was for iron.

The total amount expended for this harbor to end of the present fiscal year has been $214,074.72, which has resulted in securing a good wide channel with least depth of 16 feet. The sum of $30,000 can be expended during the period ending June 30, 1885, in prolonging the piers and in dredging.

July 1, 1882, amount available		$5,368 01
Amount appropriated by act passed August 2, 1882		10,000 00
		15,368 01
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		1,772 24
July 1, 1883, amount available		13,595 77
Amount (estimated) required for completion of existing project		60,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		30,000 00

(See Appendix K K 11.)

IMPROVEMENT OF THE HARBORS ON LAKE ERIE AT ASHTABULA AND CONNEAUT, OHIO; ERIE, PENNSYLVANIA, AND DUNKIRK, NEW YORK.

Officer in charge, Capt. M. B. Adams, Corps of Engineers, since October 6, 1882.

1. *Ashtabula Harbor, Ohio.*—The original project for the improvement of this harbor was adopted in 1826; the rock bottom was then found at 9 feet below the water surface, and there was a depth of only 2 feet of water on the bar at the entrance when operations were commenced.

The project provided piers running out on either side of the mouth of the river from shore to 12 feet water in the lake.

The present project contemplates the extension of the piers out to a depth of 16 feet, the removal of the decayed portions of both piers and rebuilding with new material, at the same time straightening the line of the west pier so as to afford a uniform width of 160 feet in the channel.

Operations were commenced in 1826, and have been prosecuted with more or less interruptions and suspensions (no work was done between

1839 and 1865) and have resulted in a much improved harbor; the close of the present fiscal year leaves a good wide channel 16 feet deep from the lake into the harbor.

There has been appropriated a total of $349,901.21 to the present time, and to the close of the fiscal year 1882 the sum of $326,739.78 had been expended.

Seven cribs required in the construction of 280 linear feet of the west pier are completed and ready to be sunk in position and filled with stone.

Revised estimates submitted by the officer in charge give the sum of $92,000 as required to complete the existing project, all of which could be profitably expended during the fiscal year ending June 30, 1885, in renewing and extending the piers, constructing a revetment on the west side of the channel, and in dredging and rock excavation.

It is probable that dredging operations will have to be carried on at this harbor as frequently as once in two years in order to maintain a depth of 16 feet in the channel.

July 1, 1882, amount available	$3,161 43
Amount appropriated by act passed August 2, 1882	20,000 00
	23,161 43
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	1,992 00
July 1, 1883, amount available	21,169 43
Amount (estimated) required for completion of existing project	92,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	92,000 00

(See Appendix L L 1.)

2. *Conneaut Harbor, Ohio.*—The original project for the improvement of this harbor was adopted in 1829. Operations were carried on during the years 1829 to 1832 and from 1836 to 1838 inclusive, which consisted in the construction of piers 125 feet apart, running from shore out to a depth of 12 feet of water in the lake, and in dredging. The design was to afford a depth of 12 feet of water through the bar at the mouth of Conneaut Creek, which bar was dry at low water when work was commenced.

The improvements have been prosecuted at this harbor with more or less of interruptions and suspensions; no work was done from 1839 to 1844, from 1845 to 1852, from 1853 to 1866, and none last year or this. The best channel depth ever obtained was 11 feet, and the more usual depth has been 8 or 9 feet.

The present depth of water on the bar is 10 feet.

Up to the close of the present fiscal year the sum of $112,629.39 has been appropriated for this harbor, of which sum $112,576.21 has been expended. The present project for this improvement contemplates rebuilding the east pier and renewing the superstructure of the west pier at an estimated cost of $35,000.

The commerce of the port has always been small.

July 1, 1882, amount available	$231 23
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	178 05
July 1, 1883, amount available	53 18
Amount (estimated) required for completion of existing project	35,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	35,000 00

(See Appendix L L 2.)

3. *Erie Harbor, Pennsylvania.*—The original survey of this harbor was made in 1819, at which time the channel was narrow and tortuous, with a depth of only 6 feet.

In 1823 a plan for the improvement of the harbor by a Board of Engineers was adopted, and which constitutes the present protection at the entrance of the harbor, excepting some changes which have been required, either on account of the age of the structure originally built or other causes.

The piers have been extended from time to time. The present project contemplates their additional extension out to 16 feet of water in the lake and maintenance of the channel 16 feet deep from the harbor inside to the lake outside.

Operations have been prosecuted with more or less interruptions and suspensions (no work was done from 1838 to 1842, from 1846 to 1853, and none from 1855 to 1864), and have resulted in much benefit to the harbor and its channel entrance. The close of operations, in 1882, left a channel 300 feet wide and 16 feet deep, which has been maintained throughout the present fiscal year.

The amount expended up to the close of the year 1882 was $659,232.88, about one-third of which was expended upon a project for a western entrance, since abandoned, and for the protection of the peninsula.

During the present fiscal year the sum of $14,720.60 has been expended in dredging, renewal of the superstructure of the north pier, and a pile protection to the neck of the peninsula.

The work of constructing a catch-sand jetty at the east end of the peninsula is in progress, and is to be completed this season. Slight repairs to the decking of the piers are required, which are to be made before the season closes.

In order to extend both piers to present 16-foot depth in the lake 2,050 feet of pier-work are required—700 feet extension to the north pier and 1,350 feet extension to the south pier—which, at a cost of $65 per linear foot, will amount to $133,250 as the amount required to complete the existing project.

To carry out the recommendation of the Board of Engineers of June 14, 1882, $10,000 of the amount available for this harbor are to be set apart to provide for the prompt construction of a dike at the neck of the peninsula in case of necessity.

The total amount appropriated for this harbor up to the close of the present fiscal year is $681,367.23, and $660,090.70 have been expended.

July 1, 1882, amount available	$15,997	13
Amount appropriated by act passed August 2, 1882	20,000	00
	35,997	13
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	14,720	60
July 1, 1883, amount available	21,276	53
Amount (estimated) required for completion of existing project	133,000	00
Amonnt that can be profitably expended in fiscal year ending June 30, 1885.	133,000	00

(See Appendix L L 3.)

4. *Dunkirk Harbor, New York.*—The existing project for the improvement of this harbor was adopted in 1870; the object being to form an artificial harbor by constructing a breakwater 2,860 feet long and nearly parallel with the shore, and by excavating a channel so as to afford a depth of 13 feet into this harbor, the estimated cost of which was $350,000.

The breakwater construction has been carried out in part, 1,341 feet having been completed at a cost of $98,000, and the channel has been excavated to 13 feet in depth, but is quite narrow besides presenting the ragged edges of the unblasted rock, jutting out on either side, and being exposed to wind and waves from any direction between northwest around to northeast; it is therefore somewhat dangerous at times for a vessel to make the entrance. In case any further extension of the breakwater is deemed advisable the officer in charge recommends its extension to the westward 560 feet, as contemplated in the original design, which would diminish in some degree the dangers of the entrance and at the same time create additional shelter within the harbor. A total of $449,079.38 has been appropriated, of which amount $449,025.29 have been expended to the close of the fiscal year ending June 30, 1883.

The breakwater, if extended 560 feet to the westward, might also, with benefit to the harbor, be extended 300 feet eastwardly, a total of 860 feet; it would then be 659 feet shorter than its original estimated length. The cost of such extensions, with present prices of materials, would be some $70 per linear foot, and would amount to $60,200, which entire amount might profitably be expended in one season.

July 1, 1882, amount available	$3,665 90
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,611 81
July 1, 1883, amount available	54 09
Amount (estimated) required for completion of existing project	60,200 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	60,000 00

(See Appendix L L 4.)

IMPROVEMENT OF THE HARBOR OF BUFFALO ON LAKE ERIE, AND OF HARBORS ON LAKES ONTARIO AND CHAMPLAIN, AND THE RIVERS NIAGARA AND SAINT LAWRENCE—IMPROVEMENT OF OTTER CREEK, VERMONT, AND GRASS AND TICONDEROGA RIVERS, NEW YORK.

Officers in charge, Maj. Walter McFarland, Corps of Engineers, to April 30, 1883; Lieut. Col. Henry M. Robert, Corps of Engineers, since that date.

1. *Buffalo Harbor, New York.*—The project for the improvement of this harbor was adopted in 1826, the date of the first appropriation, and as modified at various times provided for the construction of a north and south pier at the mouth of Buffalo Creek, a masonry sea-wall running south from the inner end of the south pier, and a breakwater slightly less than half a mile in front of the Buffalo light-house, its long arm extending nearly parallel with the shore.

The present project was adopted in 1874, and proposed, at an estimated cost of $2,000,000, to extend the breakwater southerly an additional distance of 5,000 feet, at the end of which occurs an opening 150 feet wide from which the breakwater obliques towards the shore a farther distance of 2,800 feet, where it meets a line of crib and pile pier from the shore 1,300 feet in length.

The amount expended from the date of the first appropriation in 1826 to June 30, 1883, is $1,594,099.39. The amount expended on the present project, from its adoption in 1874 to June, 30, 1883, is $548,604.02.

The total expenditure has resulted in the construction of the north and south piers, the sea-wall, and 4,891 linear feet of breakwater.

The appropriation of $300,000 asked for will be applied to the exten-

sion of the breakwater, to the maintenance of the piers and breakwater, and to such dredging as may be necessary.

July 1, 1882, amount available		$63,923 94
Amount appropriated by act passed August 2, 1882		125,000 00
		188,923 94
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$57,461 86	
July 1, 1883, outstanding liabilities	10,066 10	
		67,527 96
July 1, 1883, amount available		121,395 98
Amount (estimated) required for completion of existing project		1,330,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		300,000 00

(See Appendix M M 1.)

2. *Niagara River, New York.*—The project for this improvement was adopted in 1881, the object being the removal, by dredging, of the bars in the channel south and east of Tonawanda Island, and the removal of submerged rocks in the outer channel west of the island, so as to afford a channel of navigable width and 13 feet depth at low water. The natural channel was from 13 to 16 feet in depth, but narrowed by bars and rocks.

The amount expended to June 30, 1883, is $5,000, and has resulted in the formation of a channel of navigable width and a depth of 13 feet at low water.

No appropriation is asked for, since all work contemplated has been done.

Amount appropriated by act passed August 2, 1882	$1,500 00
July 1, 1883, amount available	1,500 00

(See Appendix M M 2.)

3. *Wilson Harbor, New York.*—The project for the improvement of this harbor was adopted in 1873 and modified in 1877, the object being to afford a channel of navigable width and 12 feet in depth, by the extension of two parallel piers from the mouth of Twelve-Mile Creek to the 12-foot curve in the lake, with the formation of a protected channel between the piers. The mouth of the creek was originally obstructed by a bar, upon which there was a depth of about 1 foot.

Before the commencement of operations by the United States the piers had been carried about 400 feet into the lake by private enterprise.

The amount expended to June 30, 1883, is $42,054.94, and has resulted in the extension of the piers to the 8-foot curve in the lake and the formation of a protected channel between the piers of navigable width and a depth of 8 feet at low water.

The appropriation of $30,000 asked for, will be applied to pier extension and maintenance, and such dredging as may be necessary.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		2,054 94
July 1, 1883, amount available		7,945 06
Amount (estimated) required for completion of existing project		50,000 00
Amount that can be profitably expended in the fiscal year ending June 30, 1885		30,000 00

(See Appendix M M 3.)

4. *Olcott Harbor, New York.*—The project for the improvement of this harbor was adopted in 1866, at the date of the first appropriation, and

proposed to connect the deep water in the lake with deep water in Eighteen-Mile Creek, by the extension of two parallel piers from the mouth of the creek to the 11-foot curve in the lake, with the formation of a dredged channel between the piers. The project was modified in 1874 and 1880 to provide for the removal of rock found to exist in the channel between the piers. The natural channel between the mouth of Eighteen-Mile Creek and the lake was covered by a bar upon which there was a depth of about 1½ feet of water.

The amount expended to June 30, 1883, is $118,000, and has resulted in the extension of the piers to about the 9-foot curve in the lake and the formation of a protected channel between the piers of navigable width, with a depth of about 7½ feet at low water.

The appropriation of $30,000 asked for is to be applied to the extension and maintenance of the piers and the deepening of the channel between the piers.

Amount (estimated) required for completion of existing project.....	$30,000 00
Amount that can be profitably expended in fiscal year ending July 30, 1885.	30,000 00

(See Appendix M M 4.)

5. *Oak Orchard Harbor, New York.*—The earliest project for the improvement of this harbor was adopted in 1836, at the date of the first appropriation, and proposed the construction of an east and west dike approaching to within 200 feet of each other and connecting at this opening with parallel piers extending into the lake; subsequent modifications were extensions of the original project, to adjust it to the increased requirements of commerce. The present project was adopted in 1881, the object being to extend the piers to the 12-foot curve in the lake with the formation of a channel of navigable width between the piers, carrying 12 feet depth at low water. The natural channel of entrance to Oak Orchard Creek was narrow, with a depth of from 2 to 4 feet.

The total amount expended from the date of the first appropriation in 1836 to June 30, 1883, is $173,500; nothing has been expended since the adoption of the present project in 1881.

The total expenditure has resulted in extending the piers to the 9-foot curve in the lake, securing a protected channel between the piers of navigable width and 9 feet depth at low water.

The appropriation of $40,000 asked for is to be applied to the extension and maintenance of the piers and such dredging as may be necessary.

Amount appropriated by act passed August 2, 1882.....	$3,000 00
July 1, 1883, amount available.....	3,000 00
Amount (estimated) required for completion of existing project.....	97,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885..	40,000 00

(See Appendix M M 5.)

6. *Charlotte Harbor, New York.*—The earliest project for the improvement of this harbor was adopted in 1828, at the date of the first appropriation, and proposed to connect the deep water in the Genesee River with the deep water in the lake by parallel piers about 360 feet apart. The subsequent modifications were extensions of the original project so as to adjust it to the increased requirements of commerce.

The present project was adopted in 1881, the object being to extend the piers to the 15-foot curve in the lake, with the formation by dredging of a protected channel between the piers of navigable width and 15 feet depth at low water. The natural channel over the bar was tortuous, and in calm weather would admit, at ordinary stages of the lake, vessels drawing 8 feet.

The total amount expended from the date of the first appropriation in 1828 to June 30, 1883, is $321,026.58. The amount expended from the adoption of the present project in 1881 to June 30, 1883, is $2,948.18.

The total expenditure has resulted in extending the piers to the original 12-foot curve in the lake, securing a channel between the piers of navigable width and of not less than 12 feet depth at low water.

The appropriation of $80,000 asked for is to be applied to the extension and maintenance of the piers and such dredging as may be necessary.

July 1, 1882, amount available		$689 68
Amount appropriated by act passed August 2, 1882		35,000 00
		35,680 68
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		3,628 86
July 1, 1883, amount available		32,051 82
Amount (estimated) required for completion of existing project		119,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		80,000 00

(See Appendix M M 6.)

7. *Pultneyville Harbor, New York.*—The project for the improvement of this harbor was adopted in 1870, at the date of the first appropriation, and proposed the construction of a breakwater running easterly from the west shore and thence northerly into the lake, with an east pier parallel to and about 200 feet from the northerly arm of the west breakwater. The project was modified in 1875 to provide for increased dredging. The object of the improvement was to furnish a protected channel of navigable width and not less than 10 feet depth. The natural channel was not more than 2 feet deep.

The total amount expended to June 30, 1883, is $67,451.41, and has resulted in the formation of a sheltered area of about 4 acres connected with the deep water of the lake by a channel of navigable width and 6 feet depth at low water.

The appropriation of $2,000 asked for is to be applied to such repairs and contingent dredging as may be necessary, or held in reserve for such purposes.

Amount appropriated by act passed August 2, 1882		$4,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		451 41
July 1, 1883, amount available		3,548 59
Amount that can be profitably expended in fiscal year ending June 30, 1885, in contingent dredging and repairs		2,000 00

(See Appendix M M 7.)

8. *Great Sodus Harbor, New York.*—The earliest project for the improvement of this harbor was adopted in 1828; the first appropriation was made in 1829.

The original project proposed the construction of two breakwaters from the east and west shores approaching to within 500 feet of each other and connecting at this opening with parallel piers extending into the lake. Subsequent modifications were extensions of the original project to adjust it to the increased requirements of commerce.

The present project was adopted in 1882, the object being to extend the piers to the 15-foot curve in the lake, and dredging a channel between the piers 15 feet deep at low water. The natural channel would admit vessels drawing 8 feet at ordinary stages of the lake.

The total amount expended from the date of the first appropriation in 1829 to June 30, 1883, is $355,219.26. The amount expended from the adoption of the present project in 1882, to June 30, 1883, is $3,447.46.

The total expenditure has resulted in the extension of the west pier to the 12-foot curve in the lake, the extension of the east pier to the 9-foot curve, securing a channel between the piers of navigable width and 10 feet depth at low water.

The appropriation of $40,000 asked for is to be applied to the extension and maintenance of the piers and for such dredging as may be necessary.

Amount appropriated by act passed August 2, 1882		$25,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$2,374 83	
July 1, 1883, outstanding liabilities	1,072 63	
		3,447 46
July 1, 1883, amount available		21,552 54
Amount (estimated) required for completion of existing project		75,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		40,000 00

(See Appendix M M 8.)

9. *Little Sodus Harbor, New York.*—The earliest project for the improvement of this harbor was adopted in 1829, and has since been variously modified. The first appropriation was made in 1852. The early projects proposed the partial closing of the opening between the bay and the lake by lateral dikes connected with two parallel piers extending into the lake. The present, which is an expansion of the earlier projects, was adopted in 1881, and is designed to afford a channel of navigable width and not less than 15 feet depth at low water.

The total amount expended from the date of the first appropriation in 1852, to June 30, 1883, is $237,947.02; the amount expended from the adoption of the present project in 1881 to June 30, 1883, is $3,505.25.

The total expenditure has resulted in the extension of the piers to the 11-foot curve in the lake, securing a channel between the piers of navigable width, and 14 feet depth, with a channel through the outer bar 12 feet deep at low water.

The appropriation of $40,000 asked for is to be applied to the extension and maintenance of the piers, and such dredging as may be necessary to maintain a channel through the outer bar.

July 1, 1882, amount available		$1,716 40
Amount appropriated by act passed August 2, 1882		25 000 00
		26,716 40
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$1,367 20	
July 1, 1883, outstanding liabilities	3,854 45	
		5,221 65
July 1, 1883, amount available		21,494 75
Amount (estimated) required for completion of existing project		55,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		40,000 00

(See Appendix M M 9.)

10. *Oswego Harbor, New York.*—The earliest project for the improvement of this harbor was adopted in 1827, and proposed to inclose an area at the mouth of the river by extending jetties from the shore into the lake, joining the outer ends by a breakwater, but leaving an opening through which to enter the harbor. This project was completed in 1869, and forms the present inner harbor.

The present project was adopted in 1870 and consists of a breakwater

5,800 feet in length, parallel to the old west breakwater and 1,100 feet in advance of it. The estimated cost was $1,161,682. It was modified in 1879, 1880, and 1882 by the proposed construction of an east breakwater 2,700 feet in length, the reduction to 350 feet of the opening between the east end of the west breakwater and the north end of the light-house pier, the use of creosoted timber in repairs to the old breakwater, and the construction of spurs along the face of the outer west breakwater to reduce the effect of accumulated seas.

The object of these improvements was to give protection to the city docks and wharves and to the commerce of the harbor and lake, suitable for the heaviest draught of vessels on the lakes. The natural entrance to the mouth of the river was shallow and difficult of access.

The total amount expended from the date of the first appropriation, in 1826, to June 30, 1883, is $1,419,501.30; the amount expended from the adoption of the present project to June 30, 1883, is $946,138.43.

The total expenditure has resulted in the completion of the originally projected harbor, the completion of the west breakwater, with the reduction to 350 feet of the opening between the east end of the west breakwater and the north end of the light-house pier, and the construction of 213 linear feet of the east breakwater; thus securing full protection to the docks and wharves west of the river mouth, and channels of entrance 16 feet deep and 350 feet wide each to the inner harbor and to the outer harbor, and 15 feet deep at low water.

The appropriation of $150,700 asked for is to be applied to the extension of the east breakwater, the construction of spurs along the outer face of the west breakwater and to the repairs of the breakwater.

July 1, 1882, amount available		$86 58
Amount appropriated by act passed August 2, 1882		80,000 00
		80,086 58
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		15,225 01
July 1, 1883, amount available		74,861 57
Amount (estimated) required for completion of existing project		150,682 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		150,700 00

(See Appendix M M 10.)

11. *Sackett's Harbor, New York.*—The project for the improvement of this harbor was adopted in 1881, and proposed the deepening of the harbor over an area of about 15 acres to a depth of 12 feet at low water. The depth previously existing was less than 8 feet over a large part of its area. In 1826 and 1828 the sum of $6,000 was expended in "cleaning and deepening" the harbor. The total amount expended from 1826 to June 30, 1883, is $8,149.18; the amount expended from the adoption of the present project to June 30, 1883, is $2,149.18, and has resulted in the removal of 8,510 cubic yards of sand, mud, and gravel. With the completion of this season's operations the harbor will have a depth of 12 feet at low water over its available area. No further appropriation is asked for by the officer in charge.

Amount appropriated by act passed August 2, 1882		$7,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$447 18	
July 1, 1883, outstanding liabilities	1,702 00	
		2,149 18
July 1, 1883, amount available		4,850 82
Amount (estimated) required for completion of existing project		15,000 00

(See Appendix M M 11.)

12. *Ogdensburg Harbor, New York.*—The project for the improvement of this harbor was adopted in 1867 and 1868, and proposed the deepening of the channel of the Oswegatchie River below the bridge, and deepening the channel in the Saint Lawrence River along the city front to a depth of 12 feet, and the construction, if subsequently deemed necessary, of dikes to confine and direct the river currents. The project was modified in 1882 by increasing the depth of the hitherto proposed channels to 15 feet at low water. The natural or unimproved channels had a depth of from 5 to 12 feet. The total amount expended from the date of the first appropriation, in 1852, to June 30, 1883, is $112,596.07; the amount expended from the adoption of the present project to June 30, 1883, is $2,590 51. The total expenditure has resulted in the formation of a channel along the Saint Lawrence River front 1½ miles in length and 12 feet in depth at low water, and the deepening of the Oswegatchie Channel to the depth of from 12 to 15 feet at low water.

The appropriation of $40,000 asked for will be applied to deepening the channels as hitherto proposed.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$467 95	
July 1, 1883, outstanding liabilities	2,122 56	
		2,590 51
July 1, 1883, amount available		7,409 49
Amount (estimated) required for completion of existing project		66,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		40,000 00

(See Appendix M M 12.)

13. *Waddington Harbor, New York.*—The project for the improvement of this harbor was adopted in 1872, its object being to open a channel of navigable width through the bar at the head of Little River to a depth of 11 feet at low water, and to facilitate the entrance to the docks below the dam by the removal of a small amount of material. The natural depth over the bar was about 7 feet.

The amount expended to June 30, 1883, is $35,500, and has resulted in the formation of a channel at the head of the river of navigable width and a depth of 11 feet at low water, with the removal of considerable material from the channel below the dam. The work originally proposed is completed, and no additional appropriation is asked for.

(See Appendix M M 13.)

14. *Grass River, New York.*—The project for this improvement was adopted in 1881, its object being the formation of a 4-foot channel from the mouth of the river to the landing for the village of Massena, a distance of 7½ miles. The natural depth at the shoalest points in the channel was about 2 feet.

The amount expended to June 30, 1883, is $51.40, and has been expended in the necessary preparation for the work proposed. But a single bid was received in response to advertisement for dredging, and since the funds available would not permit the accomplishment of more than one-fourth the required work, it was considered best to defer the work until additional appropriations would permit it to be done economically.

The appropriation of $9,000 asked for, together with unexpended balance, will be applied to deepening the channel.

Amount appropriated by act passed August 2, 1882	$3,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	51 40
July 1, 1883, amount available	2,948 60
Amount (estimated) required for completion of existing project	9,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	9,000 00

(See Appendix M M 14.)

15. *Plattsburg Harbor, New York.*—The project for the improvement of this harbor was probably adopted about 1836, the date of the first appropriation. This and the subsequent modifications proposed the construction of a breakwater about 1,000 feet distant from the docks and wharves, and giving protection to them from easterly and southerly storms. The last modification was made in 1870, and proposed an additional extension of the breakwater to the southeast, with the dredging of shoal areas behind the breakwater, and the protection by revetment of a part of the adjacent beach.

The total expenditures from the date of the first appropriation in 1836 to June 30, 1883, is $137,096.05; and the amount expended from the adoption of the present project in 1870 to June 30, 1883, is $51,596.05.

The total expenditures have resulted in the construction of 1,250 linear feet of breakwater. The breakwater was completed in 1874–'75, and since then expenditures have been limited to dredging and repairs.

The appropriation of $5,000 asked for will be applied to such dredging and repairs as may become necessary.

July 1, 1882, amount available	$1,629 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	225 05
July 1, 1883, amount available	1,403 95
Amount (estimated) required for completion of existing project	12,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	5,000 00

(See Appendix M M 15.)

16. *Swanton Harbor, Vermont.*—The project for the improvement of this harbor was adopted in 1873, its object being the construction of a breakwater to give protection to anticipated docks and wharves.

The amount expended to June 30, 1883, is $65,855.18, and has resulted in the extension of the breakwater to a length of 259 feet.

The site of the breakwater was selected before the location of the existing docks and wharves, which are ¾ of a mile from the breakwater, thereby receiving very little if any protection therefrom. In view of this fact and the uncertainty of the future location of docks and wharves, now under consideration, it is recommended that further appropriations be withheld until the establishment of docks and wharves shall give indications of requirement for further extension of the breakwater.

July 1, 1882, amount available	$1,909 06
Amount appropriated by act passed August 2, 1882	4,500 00
	6,409 06
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	1,764 24
July 1, 1883, amount available	4,644 82
Amount (estimated) required for completion of existing project	170,000 00

(See Appendix M M 16.)

17. *Burlington Harbor, Vermont.*—The project for the improvement of this harbor was probably adopted about 1836, the year in which the first appropriation was made, and subsequent modifications were an extension of the original project, the object being to afford protection to the docks and wharves, and shelter to the commerce of Lake Champlain by the construction of a breakwater about parallel with, and 1,000 feet distant from, the docks and wharves; the last modification was made in 1874, and proposed an additional extension of the breakwater northward for a distance of 2,000 feet. In its natural condition the harbor was unsheltered from northerly, west, and southwesterly winds.

The total expenditure from the date of the first appropriation in 1836 to June 30, 1883, is $452,030.69, and the amount expended from the date of the present project in 1875 to June 30, 1883, is $105,858.49.

The total expenditure has resulted in the construction of about 3,271 linear feet of breakwater.

The appropriation of $50,000 asked for will be applied to the extension of the breakwater and such repairs as are required for the preservation of the work.

July 1, 1882, amount available	$2,803	26
Amount appropriated by act passed August 2, 1882	12,000	00
	14,803	26
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	8,661	75
July 1, 1883, amount available	6,141	51
Amount (estimated) required for completion of existing project	238,000	00
Amount that can be profitably expended in fiscal year ending June 30, 1885	50,000	00

(See Appendix M M 17.)

18. *Otter Creek, Vermont.*—The project for this improvement was adopted in 1872, and modified in 1882, its object being to afford a channel of navigable width, with a depth of 8 feet at low water, between Vergennes and Lake Champlain. In its natural condition the creek was obstructed with snags, shoals, and reefs, which reduced its available depth to less than 5 feet.

The amount expended to June 30, 1883, is $29,964.03, and has resulted in the removal of all snags, the deepening of a channel through Vergennes Basin, and the improvement of several bars.

The appropriation of $20,000 asked for will be applied to the deepening of the channel through the rocky reefs and dredging through obstructing bars.

July 1, 1882, amount available	$5,780	34
Amount appropriated by act passed August 2, 1882	2,000	00
	7,780	34
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,744	37
July 1, 1883, amount available	4,035	97
Amount (estimated) required for completion of existing project	39,748	40
Amount that can be profitably expended in fiscal year ending June 30, 1885	20,000	00

(See Appendix M M 18.)

19. *Ticonderoga River, New York.*—The project for this improvement was adopted in 1881, its object being to afford a channel of navigable width with a depth of 8 feet at low water, between Lake Champlain and the Falls at Ticonderoga Village, a distance of about 2 miles.

The amount expended to June 30, 1883, is $8,485.80, and has resulted

in the partial improvement of the channel from the Lake to within one-fourth of a mile of the falls.

The appropriation of $10,000 asked for will be applied to deepening and widening the partially dredged channel.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,485 80
July 1, 1883, amount available	1,514 20
Amount (estimated) required for completion of existing project	32,516 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	10,000 00

(See Appendix M M 19.)

PACIFIC COAST.

IMPROVEMENT OF THE HARBORS OF OAKLAND AND WILMINGTON; OF SACRAMENTO AND SAN JOAQUIN RIVERS; OF PETALUMA CREEK, AND OF HUMBOLDT BAY AND HARBOR, CALIFORNIA.

Officer in charge, Lieut. Col. G. H. Mendell, Corps of Engineers.

1. *Oakland Harbor, California.*—There were delivered by contract during the year, 32,351 tons of stone, and laid up in dry masonry on the jetties 38,059 square feet. There remain to be delivered under contract about 8,000 tons of stone. An extension of time was granted the contractors.

The dredging contract was begun in March, 1883, and during the year 92,055 cubic yards were dredged and placed ashore at a cost of 19½ cents per cubic yard. The contract includes an additional amount of 500,000 yards.

The condemnation proceedings were completed in September on the filing of a decree in court awarding $39,696 as the value of 86⅔ acres of land required for the San Leandro Canal. The city of Oakland is to pay $25,000, leaving $14,696 to be paid by the United States.

The money now available is to be applied to existing contracts for stone and dredging and to a second contract for dredging.

The first appropriation for this work was by river and harbor act of June 23, 1874. At the beginning of the improvement the depth on the bar at the entrance was at low stage 3 feet, and high stage 9 feet; the average draught of vessels about 5 feet. The present depths are 14 feet at low, and 20 feet at high water; the average draught of vessels using the channel, 12 feet. The total amount that has been appropriated is $735,000, and the amount expended to end of the fiscal year, June 30, 1883, $546,916.32.

The amount asked for the coming fiscal year is to be applied to increasing the tidal prism by dredging and by construction of the San Leandro Canal, including the payment for land above mentioned, should Congress give the requisite authority, and to the extension of the channel depth of 14 feet to the front of Oakland.

July 1, 1882, amount available		$63,389 92
Amount appropriated by act passed August 2, 1882		200,000 00
		263,389 92
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$69,232 06	
July 1, 1883, outstanding liabilities	6,074 18	
		75,306 24
July 1, 1883, amount available		188,083 68

Amount (estimated) required for completion of existing project	$1,044,579 50
Amount that can be profitably expended in fiscal year ending June 30, 1885	300,000 00

(See Appendix N N 1.)

2. *Wilmington Harbor, California.*—The bar at the entrance has lost about 1 foot in depth during the year. The deposit is soft sand, through which steamers drawing a foot more water than actually exists, force themselves without difficulty.

Dredging on the reef was begun October 9, and at the close of the year the contractor had removed 26,550 cubic yards of reef material, and 1,870 cubic yards of sand, giving a depth of 16 feet at mean low water for a width on the reef of 230 feet. The contract will probably be fulfilled in August.

Inside the reef 1,313 cubic yards of sand were dredged, the machine being hired for the purpose. Some repairs were made by hired labor along the timber jetty for a distance of 9,000 feet, stopping all leaks; the material used was 1,022 tons of clay and 1,076 tons of gravel. The disturbance of the bottom made by the wreck Adelaide Cooper has been nearly obliterated.

The first appropriation for this work was by the river and harbor act of March 3, 1871. Before improvement there was a variable depth of one to two feet at low water on the bar at the entrance, and all freight and passengers had to be lightered for several miles. The present depth varies from 8 to 10 feet at low water, and 14 to 16 feet at high water. Vessels drawing 14 feet now enter and deliver freight at the wharves. Vessels of deeper draft still discharge by lighters.

The total amount that has been appropriated is $655,000, and the amount expended to end of fiscal year, June 30, 1883, $625,083.66.

The amount asked for the coming year will be applied to dredging sand, estimated at 120,000 cubic yards, lying at and near the entrance, to extending the west jetty and raising the east jetty.

July 1, 1882, amount available		$6 24
Amount appropriated by act passed August 2, 1882		100,000 00
		100,006 24
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$63,091 09	
July 1, 1883, outstanding liabilities	6,998 81	
		70,089 90
July 1, 1883, amount available		29,916 34
Amount (estimated) required for completion of existing project		191,766 42
Amount that can be profitably expended in fiscal year ending June 30, 1885		125,000 00

(See Appendix N N 2.)

3. *Sacramento and Feather rivers, California.*—The snag-boat Seizer was in commission 188 days, 17 of which were in the San Joaquin River, leaving 171 days on the Sacramento and its arms and tributaries.

The work done was, on the Sacramento, the removal of 873 snags and 19 trees; on the Feather, 133 snags, 30 trees; on Georgiana Slough, 71 snags and 170 trees.

By the use of the scraper about an additional foot of water was secured at California Island, at Call's Bend, at Pike's, and at Fremont. The channel at Monroeville was widened 50 feet by the same means. The scraper worked 6¾ days. No dams were built during the season.

The absence of permanent banks on the Upper Sacramento points out temporary improvements of bars as the appropriate treatment whether by dams or by scraping.

The improvement of Six-Mile Bar, for which bids were asked, was unnecessary, the river having improved itself by large deposits of mining detritus on the sides of the channel. This fact was developed by a survey of the bar made by Capt. C. F. Palfrey, Corps of Engineers, in August. Captain Palfrey has been in charge of the snag-boat and the river operation since October.

The barge Aid was built during the year under contract; she is a tender to the *Seizer*.

The first appropriation was made by the river and harbor act of March 3, 1875. The improvement of these rivers has comprised the construction of wing-dams to give greater depths in shallow places, and the removal of snags from the channel and impending trees from the banks.

The Upper Sacramento changes its bed in many places with great facility, and the clearance of snags is indispensable to its navigation. But for these operations a large portion of the river, forming an outlet for a large agricultural country, would have become unnavigable.

The total amount that has been appropriated for both rivers is $405,000, and the amount expended to end of fiscal year, June 30, 1883, is $379,533.20.

The river and harbor act of August 2, 1882, appropriated $250,000 for improving Sacramento River, California, for the improvement and protection of the navigable channel of the Sacramento and Feather rivers, to be expended under the direction of the Secretary of War. Of this sum $40,000 was allotted for snagging operations on the Sacramento River. The officer in charge submits an estimate of $40,000 for carrying on these snagging operations and to the maintenance of the snag-boat.

July 1, 1882, amount available		$14,885 53
Amount appropriated by act passed August 2, 1882		250,000 00
		264,885 53
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$28,220 73	
July 1, 1883, outstanding liabilities	6,198 00	
		34,418 73
July 1, 1883, amount available		230,466 80
Amount that can be profitably expended in fiscal year ending June 30, 1885		40,000 00

(See Appendix N N 3.)

4. *San Joaquin River, California.*—Under a contract with Alexander Gall, dated November 6, 1882, 17,580 cubic yards were dredged in Mormon Slough and placed on the banks above high water. Under a contract with Angus McKinnon, dated November 18, 1882, a barrier 350 feet long of piling was built across the depression through which the drainage of the back country reaches Mormon Slough. The general height of the barrier is about 3 feet. It is, however, 10 feet high for part of its length. The object of the barrier is to cause deposit of sediment carried by the drainage water before it reaches the navigable channels. The moderate freshets occurring since the completion of the barrier have left behind it, by approximate estimate, 24,700 cubic yards. Part, however, of the sediment reached the navigable waters and impaired the channel dredged by Mr. Gall.

The land necessary to the cut-off at the Devil's Elbow was secured during the winter, and on March 30 a contract was made for the excavation. Work has not yet been begun, it being expedient to delay until after the spring freshet. It will be begun about the first of September.

The snag-boat Seizer spent 16 days in the San Joaquin, and removed 89 snags and 30 trees.

A survey of the upper river from Hill's Ferry to Stockton, a distance of 92½, miles, was made in the autumn of 1882.

The first appropriation for this improvement was by the river and harbor act of August 14, 1876. Two permanent improvements have been made in the channel of the river by the excavation of canals 100 feet wide and 10 feet deep to straighten an abruptness of the bends of the river that made the passage difficult for the daily steamers and delayed sailing vessels.

Channels have been dredged to great advantage in Stockton and Mormon sloughs, permitting full loads to be carried in the low stage of water. These improvements have encouraged the establishment of warehouses and a grist-mill at Stockton, which is a center of wheat trade. The construction of brush dams in the bed of the upper river and the removal of snags have facilitated navigation. The capacity of the river for commerce has been materially increased by the above improvements.

The total amount that has been appropriated is $100,000, and the amount expended to end of fiscal year, June 30, 1883, is $70,502.26.

The money asked for the coming year will be applied to dredging in Mormon and Stockton sloughs and the vicinity, and to the removal of snags and the improvement of bars, as the necessity arises.

July 1, 1882, amount available		$5,078 95
Amount appropriated by act passed August 2, 1882		40,000 00
		45,078 95
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		15,581 21
July 1, 1883, amount available		29,497 74
Amount that can be profitably expended in fiscal year ending June 30, 1885		40,000 00

(See Appendix N N 4.)

5. *Petaluma Creek, California.*—A contract for dredging was made October 18, 1882, but work was not commenced until February 19, 1883, since which date it has been slowly prosecuted. The quantity dredged and deposited on shore in accordance with the terms of the contract was, to June 30, 25,290 cubic yards. The work is to be completed in August, including the dredging of the cut-off, which will complete the work as originally projected.

The first appropriation for this stream was by the river and harbor act of June 14, 1880, the object of the improvement being to straighten and deepen the channel for 4 miles below the town of Petaluma, so as to give a convenient channel of 3 feet depth at low water. Considerable area of country, affording employment to a large number of schooners and to a line of steamers, depends, in a great measure, for its prosperity upon this navigation.

The total amount that has been appropriated is $30,000, and the amount expended to end of the fiscal year, June 30, 1883, $14,970.46.

July 1, 1882, amount available			$8,426 14
Amount appropriated by act passed August 2, 1882			14,000 00
			22,426 14
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$4,963 90		
July 1, 1883, outstanding liabilities	2,433 70		
			7,396 60
July 1, 1883, amount available			15,029 54

(See Appendix N N 5.)

6. *Humboldt Harbor and Bay, California.*—The operations of the past year consisted in dredging and in studies of the natural conditions of the bar entrance with a view to the improvement of the bar. A project for this improvement was submitted on January 17, 1883, and printed as House Ex. Doc. 102. (See also Appendix N N 6 to this report.)

Dredging was done under contract to the amount of 75,904 cubic yards, distributed as follows: in channels of the south bay leading to Hookton, 32,192 yards; in Eureka Channel, 12,288 yards; and in Arcata Channel, 31,424 yards. It is further proposed to deepen the Eureka Channel, now 10 feet deep, to 13 feet.

The total amount that has been appropriated is $80,000, and the amount expended to end of fiscal year, June 30, 1883, $62,006.

The money asked for the coming year will be applied to the improvement of the entrance.

July 1, 1882, amount available		$130 03
Amount appropriated by act passed August 2, 1882		40,000 00
		40,130 03
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$20,238 44	
July 1, 1883, outstanding liabilities	1,897 60	
		22,136 04
July 1, 1883, amount available		17,993 99
Amount (estimated) required for completion of existing project		600,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		250,000 00

(See Appendix N N 6.)

Removal of sunken vessels obstructing or endangering navigation.—The British iron screw steamer Escambia, with a cargo of wheat, was foundered on the bar at the entrance to San Francisco Harbor, inside the crest, in 6 fathoms water, June 19, 1882, and formed for some time a serious danger to passing vessels. Three examinations by sounding were made during the fiscal year, showing a progressive settlement of the wreck in the sand. In August, 1882, the least depth was 18 feet; in November, 4½ fathoms; in May, 1883, 5½ fathoms.

The bids first asked for its removal, August 28, 1882, were declined. A second advertisement was issued, but withdrawn when the November examination showed a great increase of depth of water. It has not been practicable, as was intended in April and May, to drag the site or to examine the wreck by divers, before the end of the fiscal year. It is altogether probable that it will not be necessary to remove any part of the wreck, it having settled sufficiently in the sand to be no longer dangerous to navigation.

(See Appendix N N 7.)

IMPROVEMENT OF THE HARBOR OF SAN DIEGO, CALIFORNIA.

Officer in charge, Col. C. S. Stewart, Corps of Engineers.

To prevent injury to this harbor, from sand and soil brought into it by the San Diego River when in flood, a project was formed to turn the river from the harbor into False Bay, its former outlet. An artificial channel was cut from a point in the river to False Bay, the river was dammed, and a levee faced with stone built across its valley, between the new water-way and San Diego Bay, to prevent the overflow of the river during heavy freshets from seeking the harbor. These works

were constructed in 1876, and thus far have accomplished the desired end.

During the past year, all injuries to the levee caused by cattle, the burrowing of badgers, and by the wash from rains, have been made good, and the culvert has been cleared out and connected by a ditch 100 feet long with False Bay, at a cost of $68.

The total expenditures upon this work, from the beginning, including repairs to June 30, 1883, have been $80,240.50.

The amount available from appropriation for repairs made in 1879 will probably keep the works in repair for several years.

July 1, 1882, amount available	$827 50
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	68 00
July 1, 1883, amount available	759 50

(See Appendix O O.)

IMPROVEMENT OF RIVERS AND HARBORS IN OREGON AND IN WASHINGTON TERRITORY—IPMROVEMENT OF LOWER CLEARWATER RIVER, IDAHO—CONSTRUCTION OF CASCADES CANAL, COLUMBIA RIVER.

Officer in charge, Capt. C. F. Powell, Corps of Engineers, having under his immediate orders Lieut. P. M. Price, Corps of Engineers.

1. *Lower Willamette and Columbia rivers.*—The present project for this improvement was adopted in 1877, and modified in 1879 and 1882, the object being to afford a ship-channel of navigable width and 20 feet depth at mean low water. The project consists in a permanent contraction of waterway for improvement of the four bars between Portland and Saint Helens, Oreg., in dredging or stirring up the bottom at the bars during construction of permanent works and on shoal places in the river below Saint Helen, and in snagging operations.

The natural depth of channel at the shoalest place was not more than from 9 to 10 feet at low water, and on the other bars from 12 to 15 feet.

The amount expended to June 30, 1883, is $493,197.15, and has resulted in generally maintaining a channel of navigable width and least depth of 17 to 18 feet at low water. At one bar where permanent works have been completed more than 20 feet at low water has been obtained, and 18.5 feet at another place where works are partly built.

The appropriation of $242,000 asked for is to be applied in completing the construction of permanent works; and below the part of river reached by their application, on temporary improvement; in snagging operations, and on repairs to works left unfinished for a year; for a full explanation of which see report of officer in charge in Appendix P P 1.

The foreign and coasting trade from the Lower Willamette and Columbia rivers is large and increasing. Portland is the principal place of exportation; it is an important center of rail and water transportation lines and the head of ship navigation, being 100 miles iniand from the port at the mouth of the Columbia River.

The completion of the improvement of the ship-channel will do away with an expensive lighterage and delay now necessary at low stage.

The city of Portland built during the year a large dredge-boat, at a first cost of about $15,000, for work on the Willamette River; and a private corporation sluiced out one of the bars at its own expense of about $10,000, when public appropriations were not available.

July 1, 1882, amount available	$909 16
Amount appropriated by act passed August 2, 1882	100,000 00
	100,909 16
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	88,741 31
July 1, 1883, amount available	12,167 85
Amount (estimated) required for completion of existing project	183,635 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	242,000 00

(See Appendix P P 1.)

2. *Mouth of Columbia River, Oregon.*—The total amount appropriated for this entrance is $17,500; and was made for surveys, preparation of plan and estimates for improvement, temporary improvement, continuation of survey, and expenses of a Board of Engineers in making an examination and report of plan, with estimates for permanent improvement. The amount expended therefor is $14,534.62. The whole subject of improving the mouth of the Columbia River was considered by the Board of Engineers for Fortifications and for River and Harbor Improvements, February, 1881. For reasons given in their report, published in the Annual Report of the Chief of Engineers for 1881, the Board considered it unnecessary to submit any plan of improvement at that time.

In compliance with the provisions of the river and harbor act of August 2, 1882, a Board of Engineers examined the mouth of the Columbia River in September, and prepared plans, with estimates, for permanent improvement, the report of which was published as Senate Ex. Doc. No. 13, Forty-seventh Congress, second session. The plan approved by the Board consists in building a jetty from the south cape of the entrance on the spit there attached, although differences of opinion about the direction, length, height, and cost of the jetty were given.

In expectation of the adoption of the plan recommended, a survey was made in October and November of the south cape, Point Adams, to extreme low water; and also an examination of the region for a place of stone supply. A good one was found.

A detailed hydrographic survey of the mouth, including the sea bar, is now being made.

The north channel, which was used as the ship-channel at time of examination by the Board of Engineers, September, 1882, has since shoaled, and a channel formed to the southward, where scraping had been done in July, 1882; a filling in this channel is already reported.

The officer in charge asks for an appropriation of $500,000, to be applied in part construction of a jetty from the south cape of the entrance according to the plan approved by the Board of Engineers of 1882, with which he expects to give relief to a large and increasing shipping, obstructed during late years by a shifting and shoaling of bar channels.

Amount appropriated by act passed August 2, 1882		$7,500 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$4,159 62	
July 1, 1883, outstanding liabilities	375 00	
		4,534 62
July 1, 1883, amount available		2,965 38

(See Appendix P P 2.)

3. *Upper Willamette River, Oregon.*—The project for this improvement was adopted in 1870, modified in 1878, and its application extended in later years. The object is to afford and maintain an easy light-draught

navigation from Portland to Eugene City and on 12 miles of tributaries, making a distance of 184 miles. The work consists in snagging operations, bar scraping, and for the reach between the Willamette Falls and Corvallis, in the contraction of water-way by low cut-off or wing dams, and in rock removal. The natural channel from Portland to Willamette Falls, 12 miles, was generally deep and wide; above the falls it was narrow, tortuous, and much obstructed. The mouth of the Yamhill, 28 miles from the falls, was the head of an inconvenient low-water navigation on a draught of 2½ feet; 1 foot only could be carried above. The amount expended to June 30, 1883, is $135,303.93, and has resulted in making and generally keeping an easy channel, with a least depth during the year of 2½ feet, to Corvallis, 102½ miles from the falls, and also, except during extreme low stage, to Harrisburg, 34½ miles farther. The reach from Harrisburg to Eugene, on account of railroad facilities and difficult access from the farming region to the landings, has been abandoned during late years for navigation.

The appropriation recommended, $31,000, is to be applied to the construction of a snag-boat and 2,000 feet of low dams and to snagging operations, for part completion of the present project, and maintenance of the channel for the year.

July 1, 1882, amount available		$1,139 47
Amount appropriated by act passed August 2, 1882		5,000 00
		6,139 47
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$5,925 90	
July 1, 1883, outstanding liabilities	17 50	
		5,943 40
July 1, 1883, amount available		196 07
Amount (estimated) required for completion of existing project, exclusive of expense of annual maintenance		33,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		31,000 00

(See Appendix P P 3.)

4. *Upper Columbia and Snake rivers, Oregon and Washington Territory.*—The present project for this improvement was adopted in 1877, the object being to afford a channel of navigable width from Celilo Falls, on the Columbia near The Dalles, to Lewiston, Idaho Territory, on the Snake, with a depth at low stage of 5½ feet in the Columbia and 4½ feet in the Snake. The natural channel through the rock rapids was very narrow and tortuous, with a swift current and a depth at low stage of 2 to 4 feet. On reaches between rapids the depth is ample and throughout the banks are stable. The amount expended to June 30, 1883, is $190,859.71, and has resulted in improvement at 13 localities; 8 places remain for work under the present project. Contracts were made during the year for work at Five-mile, Little Goose Island, and Log Cabin Island rapids, on the Snake River; operations are required to be commenced on or before September 1, 1883.

The appropriation asked for ($56,000) is to be applied for completion of present project.

July 1, 1882, amount available		$128 98
Amount appropriated by act passed August 2, 1882		6,000 00
		6,128 98
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		988 69
July 1, 1883, amount available		5,140 29

Amount (estimated) required for completion of existing project..... $56,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885. 56,000 00

(See Appendix P P 4.)

5. *Canal around Cascades of Columbia River, Oregon.*—The present project for this construction was adopted in 1877 and modified in 1880. The object is to improve the river at the minor rapids and give lockage around the principal rapids of the cascades of the Columbia River for stages of 20 feet at the foot of the canal for about one-half the year, which includes the busy boating season. The plan is arranged for easy extension for higher stages of river. The canal will be about 3,000 feet long. The low-water lock will have a lift of about 24 feet. The lock capacity will be 90 by 462 feet, with a least draught of 8 feet.

The amount expended to June 30, 1883, is $725,715.93. Work during year consisted in laying 10,455 cubic yards of dry rubble or squared stone masonry and 154 cubic yards of concrete in the protective wall or side wall of canal prism on right, completing the former for its whole length of 781 feet and the latter for a partial length of 299 feet; in grading and paving the slope of the left bank at lower end of canal; minor excavations; bowlder quarrying; stone cutting, building structures incidental to the canal project, and in extensive river improvement. The latter work makes practicability of navigation for higher stages and during a longer annual period than contemplated by the project quite probable.

The appropriation of $500,000 asked for is to be applied to guard-gate and part lock construction; wing walls, completion of excavation and side walls of canal, and additional river improvement, if any be required. The officer in charge recommends especially that all of the estimated amount for next year be appropriated for advantageous work.

July 1, 1882, amount available		$517 60
Amount appropriated by act passed August 2, 1882		265,000 00
		265,517 60
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$179,713 78	
July 1, 1883, outstanding liabilities	6,519 75	
		186,233 53
July 1, 1883, amount available		79,284 07
Amount (estimated) required for completion of existing project		1,655,397 31
Amount that can be profitably expended in fiscal year ending June 30, 1885		500,000 00

(See Appendix P P 5.)

6. *Entrance to Coos Bay, Oregon.*—The present project for this improvement was adopted in 1879, the object being to open and maintain a deeper and more direct channel across the sea-bar by a jetty construction. The natural channel was shifting, usually tortuous, and with not more than from 8 to 10 feet ruling depth at low water. The mean rise of tide above this plane is 5.1 feet. The amount expended to June 30, 1883, is $97,187.63. The incomplete jetty as far as constructed is 1,645 feet long; it has afforded during the last two years of its construction a straighter and more stable channel, and generally of increased depth.

The appropriation of $150,000 asked for is to be applied in extension of the jetty. It is expected with this amount to deepen the channel permanently.

July 1, 1882, amount available		$5 58
Amount appropriated by act passed August 2, 1882		30,000 00
		30,005 58
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$25,240 26	
July 1, 1883, outstanding liabilities	1,952 95	
		27,193 21
July 1, 1883, amount available		2,812 37
Amount (estimated) required for completion of existing project		500,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		150,000 00

(See Appendix P P 6.)

7. *Lower Clearwater River, Idaho Territory.*—The present project was adopted in 1878, the object being to open a channel through rock reefs and cobble-stone bars for rafts and small river boats, not less than 60 to 75 feet wide, with 4 feet depth at low stage from the river mouth to the North Fork, a distance of 40 miles. The natural channel is impracticable for boats and difficult for rafts. The amount expended is $10,604.77, and has resulted in partial improvement at Reuben's Rapids, Kent's Chute, and Big Eddy, on the lower 32 miles.

The appropriation of $20,000 asked for is to be applied to the completion of the present project.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	604 77
July 1, 1883, amount available	4,395 23
Amount (estimated) required for completion of existing project	19,434 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	20,000 00

(See Appendix P P 7.)

8. *Entrance to Yaquina Bay, Oregon.*—The present project for this harbor was adopted in 1879, the object being to afford a permanent central channel over the bar with a depth of not less than 12 feet at mean low tide. The mean rise of tide is 7 feet. Of three natural shifting channels, the best one gave a depth from 7 to 9 feet at mean low water; the southern and northern channels are obstructed by rocks. The amount expended to June 30, 1883, is $80,974.89. A brush-mattress jetty 1,950 feet long has been constructed from the high-water line to present edge of the channel. The work caused a former south channel, leading near dangerous rocks, to fill up to less than 4 feet depth, and to deepen the middle and direct channel from 7 feet to 10 feet depth at a low stage, above which the mean rise of tide is 7 feet.

The appropriation of $140,000 asked for is to be applied in continuation of present work, to give a greater and permanent depth of channel.

July 1, 1882, amount available		$7 24
Amount appropriated by act passed August 2, 1882		60,000 00
		60,007 24
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$36,425 29	
July 1, 1883, outstanding liabilities	4,556 84	
		40,982 13
July 1, 1883, amount available		19,025 11
Amount (estimated) required for completion of existing project		355,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		140,000 00

(See Appendix P P 8.)

9. *Mouth of Coquille River, Oregon.*—The present project for the improvement of this entrance was adopted in 1880, the object being to afford, by a jetty construction, a more direct channel of navigable width and not less than 10 feet at mean low water. The mean rise of the tide is 4 feet. The natural channel was shifting, rarely carried more than 3 feet at low water, and for several years before the improvement was commenced was tortuous, shoal, and greatly obstructed by numerous rocks. The amount expended to June 30, 1883, is $19,903.27. With this amount a jetty was built of a total length of 1,365 feet, and crossing the former channel, which has been completely filled to above high water; a new, straight, direct channel, free from rocks and of 7 feet least depth at low water, was cut through the north cape of the entrance.

The appropriation of $60,000 asked for is to be applied in continuing the jetty construction and in preparations to build a similar work on the north side of the entrance.

July 1, 1882, amount available		$3 31
Amount appropriated by act passed August 2, 1882		10,000 00
		10,003 31
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$9,586 08	
July 1, 1883, outstanding liabilities	320 50	
		9,906 58
July 1, 1883, amount available		96 73
Amount (estimated) required for completion of existing project		144,200 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		60,000 00

(See Appendix P P 9.)

10. *Cowlitz River, Washington Territory.*—The project for this improvement was adopted in 1880. It consists of the removal of drift and snags and moderate scraping of bars, to give an easy, light-draught navigation at all stages as far as Toledo, 40 miles from the river mouth. The natural channel was narrow, tortuous, obstructed, and carried a least depth at low water of 2½ feet; navigation was suspended on the upper part of the route during low stages; rafting, at favorable stages, was difficult. The amount expended to June 30, 1883, is $3,927.27, and has resulted in securing a moderately free channel with a least depth of 3 feet for part of the year.

The appropriation of $6,000 asked for is to be applied to the improvement for extension of navigation 20 miles up-stream, and maintenance for the year of an easy 3-foot channel.

Amount appropriated by act passed August 2, 1882		$1,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities, July 1, 1882		927 27
July 1, 1883, amount available		72 73
Amount (estimated) required for completion of existing project		3,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885, including expense of annual maintenance		6,000 00

(See Appendix P P 10.)

11. *Skagit, Steilaquamish, Nootsack, Snohomish, and Snoqualmie rivers, Washington Territory.*—The present project for improvement of these rivers was adopted in 1882, the object being to annually clear them, to heads of navigation, of snags, rafts and drift, with moderate scraping of bars.

A contract has been made for the construction of a snag-boat. The

appropriation of $15,000 asked for is to be applied to the operations of a snag-boat during the year and addition of appliances not included in present construction.

Amount appropriated by act passed August 2, 1882		$20,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$1,015 67	
July 1, 1883, outstanding liabilities	48 00	
		1,063 67
July 1, 1883, amount available		18,936 33
Amount (estimated) required for completion of existing project, exclusive of expense of annual maintenance		5,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		15,000 00

(See Appendix P P 11.)

12. *Chehalis River, Washington Territory.*—The present project for this improvement was adopted in 1882, the object being to annually clear the river of snags, rafts, and drift for a navigable width with the natural depth to Claquato, 70 miles, and head of river navigation. The appropriation of August 2, 1882, is the first one for this improvement.

The appropriation of $5,000 asked for is to be applied for maintenance of the channel under the present project.

Amount appropriated by act passed August 2, 1882	$3,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	95 55
July 1, 1883, amount available	2,904 45
Amount (estimated) required for completion of existing project	5,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	5,000 00

(See Appendix P P 12.)

13. *Gauging waters of the Columbia River.*—The act of August 2, 1882 is the first appropriation for this work. A self-registering gauge was set up at Astoria in February, and has been operated since, and record of reports of pilots made, to test value of gauge-record as an indicator of bar condition, by a comparison of a large number of observations.

The amount estimated for, $3,000, is for water-gauges on the Columbia River and principal tributaries.

Amount appropriated by act passed August 2, 1882	$500 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	451 48
July 1, 1883, amount available	48 52
Amount that can be profitably expended in fiscal year ending June 30, 1885	3,000 00

(See Appendix P P 13.)

EXAMINATIONS, SURVEYS, AND CONTINGENCIES OF RIVERS AND HARBORS.

For examinations and surveys for improvements, and for contingencies, and for incidental repairs of harbors for which there is no special appropriation, an appropriation of $150,000 should be made, of which sum $50,000 for surveys and $100,000 for contingencies, including incidental repairs of harbors.

MAINTENANCE AND REPAIRS OF WASHINGTON AQUEDUCT—INCREASING WATER-SUPPLY OF THE CITY OF WASHINGTON—ERECTION OF FISH-WAYS AT THE GREAT FALLS OF THE POTOMAC.

Officer in charge, Maj. G. J. Lydecker, Corps of Engineers, with Capt. R. L. Hoxie, Corps of Engineers, under his immediate orders.

1. *Washington Aqueduct.*—The appropriation of $20,000 has been applied, in general, to the usual routine work necessary for the proper maintenance and distribution of the water supply, and the care and preservation of the aqueduct and its accessory structures.

The quantity of water drawn from the receiving reservoir in the twenty-four hours ending 6 a. m. June 27, was 24,314,715 gallons. This is 5,413,149 gallons less than that shown by last year's measurement made June 26, 1882, and results from the active measures taken to repress the great waste of water in the lower districts, whereby much inconvenience, in many cases amounting to actual distress, was caused in the more elevated portions of Washington.

The following is a financial statement for the fiscal year ending June 30, 1883:

Amount available July 1, 1882	$3,531 13	
Amount appropriated by act of July 1, 1882	20,000 00	
Amount appropriated by act of March 3, 1883	20,000 00	
		$43,531 13
Covered into the Treasury November 20, 1882	1,354 17	
Expended during the year	20,454 55	
Outstanding liabilities June 30, 1883	1,722 41	
		23,531 13
Balance available June 30, 1883		20,000 00

Amount required for the fiscal year ending June 30, 1885, is $22,000. This is $2,000 in excess of the annual appropriations for the past five years, which is sufficient only for maintenance and ordinary repairs; but it is necessary to construct an overfall at the receiving reservoir, in order to carry the waste water over the conduit, and up to the present time the amounts appropriated have not been sufficient to afford means for this purpose. It is proposed to apply this extra $2,000 to that object.

(See Appendix Q Q 1.)

2. *Increasing the water-supply of the City of Washington.*—This work is to be done in pursuance of an act approved July 15, 1882. Operations during the year have been confined to making such examinations, surveys, and maps as were required for the preparation of a detailed project, and to comply with the requirements of the law in the matter of land condemnation. In the course of these examinations a trial shaft was sunk in the grounds of the Howard University, in order to obtain precise information as to the depth of bed-rock and the varying character of the overlying strata.

The project submitted by the officer in charge provides (1) for raising the dam at the Great Falls to a height of 148 feet above tide, and extending it at that height to the Virginia shore; (2) for extending the aqueduct by a tunnel from the distributing reservoir to the site selected for the new reservoir, near Howard University; (3) for constructing the new reservoir; and (4) for reenforcing the city water supply by new mains from that reservoir. The work will be commenced as soon

as practicable, the Attorney-General having published his advertisement of lands to be taken.

The following is a money statement for the fiscal year ending June 30, 1883:

Amount appropriated by act of July 15, 1882	$1,485,279 30
Amount expended during the year	15,174 27
Amount available June 30, 1883	1,470,105 03

No additional appropriation is asked for the year ending June 30, 1885.

(See Appendix Q Q 2.)

3. *Erection of fish-ways at Great Falls of the Potomac River.*—This work is to be done in pursuance of an appropriation contained in the bill for increasing the water-supply of Washington, D. C., on plans to be prepared under the direction of the United States Commissioner of Fish and Fisheries. Preliminary surveys have been made under his direction, but the plans have not yet been prepared.

It is proposed to carry on the work in connection with the construction of the dam at the Great Falls.

The following is a money statement for the fiscal year ending June 30, 1883:

Amount appropriated by act of July 15, 1882	$50,000 00
Amount expended during the year	867 33
Amount available June 30, 1883	49,132 67

No additional appropriation is asked for the fiscal year ending June 30, 1885.

(See Appendix Q Q 3.)

IMPROVEMENT AND CARE OF PUBLIC BUILDINGS AND GROUNDS IN AND AROUND WASHINGTON.

Officer in charge, Col. A. F. Rockwell, U. S. A.

The care necessary to maintain them in good order was bestowed upon the improved portions of the public grounds in the District of Columbia, and additional and satisfactory progress was made in the work of improving the grounds south of the Executive Mansion. An additional new greenhouse was erected in the nursery grounds, three of the smaller unimproved triangular spaces, one on Virginia avenue, between Twelfth and B streets southwest, one on Massachusetts avenue, between Twentieth and P streets northwest, and the third on Rhode Island avenue, near Tenth street northwest, were graded, sodded, planted, and inclosed with post and chain fences, and the work of improving reservation numbered 17, southeast of the Capitol, was commenced.

Attention is invited to the detailed report of the officer in charge, and his estimates for the coming fiscal year are recommended as follows:

For improvement and care of public buildings and grounds	$166,500
For compensation of persons employed on and around public buildings and grounds	49 060
For contingent and incidental expenses	500
For rent of office, public buildings and grounds	900
	216,960

(See Appendix R R.)

MISSISSIPPI RIVER COMMISSION.

This Commission, organized under the provisions of the act of June 28, 1879, reports to and receives instructions from the Secretary of War through this office.

Information regarding the progress of the Commission in its duties was transmitted to Congress, as required by the above act, in a report dated December 1, 1882, which was printed as Senate Ex. Doc. No. 32, Forty-seventh Congress, second session. This report embraces the following subjects and subdivisions:

1. Progress of surveys and examinations since October 1, 1881. Detailed statements of expenditures from the appropriations for those purposes, and estimates of funds for continuing this work for the fiscal year ending June 30, 1884.
2. Construction. Detailed statements of expenditures from the appropriation of March 3, 1881, and from the appropriation of August 2, 1882, to December 1, 1882.
3. Remarks on the subjects of levees and outlets.
4. Legislation.
5. References to miscellaneous appendixes submitted with the report.

(See Appendix S S.)

SURVEYS OF NORTHERN AND NORTHWESTERN LAKES.

The work of this survey, in charge of Lieut. Col. C. B. Comstock, Corps of Engineers, was completed at the close of the fiscal year ending June 30, 1882, there remaining at that date only the work necessary to complete the printing of the final report, and to arrange and transfer the records to this office.

The office of the survey was closed in August, 1882, and the records transferred to this office. The printing of the final report was completed in November, 1882.

The water-level observations have been continued since July 1, 1882, by the Engineer officers in charge of works of harbor improvements on the lakes.

Under the supervision of this office the engraving of Lake Erie Coast Chart No. 7 has been completed, and the following engraved plates have been electrotyped:

West end, Lake Superior.
North end of Green Bay.
South end of Green Bay.
Grand and Little Traverse Bays.
Saint Lawrence River, No. 2.
Saint Lawrence River, No. 6.

The following have been placed in the hands of the electrotyper:

Lake Erie coast chart, No. 7.
Sandusky Bay.
South end of Lake Huron.
Sand Beach.
Saginaw Bay.
Saginaw River.

The issue of charts was continued from July 1, 1882, by Lieut. Col. G. Weitzel, Corps of Engineers, who was succeeded by the late Maj. F. U. Farquhar, Corps of Engineers, July 31, 1882, and the annual report, submitted by Col. O. M. Poe, lieutenant-colonel of Engineers, who has

been assigned to the charge of the works of Major Farquhar, will be found in Appendix T T.

During the fiscal year 7,596 charts were issued.

Amount available for fiscal year 1883–1884	$3,000
Amount required for survey of Northern and Northwestern Lakes for the fiscal year ending June 30, 1885, namely for printing and issuing charts for the use of navigators and electrotyping copper plates for chart printing	3,000

MILITARY AND GEOGRAPHICAL MAPS.

The southeastern and southwestern sheets of the new map of the territory of the United States west of the Mississippi River, scale $\frac{1}{2000000}$, have been engraved on stone. The northeastern sheet is now in the hands of the engraver.

Considerable progress has been made in the compilation of the new outline map of the United States, scale $\frac{1}{5000000}$. The southeastern sheet of this map has been completed and engraved on stone.

A map of Southwestern New Mexico, by Lieut. O. M. Carter, Corps of Engineers, 1883, has been photolithographed and an edition printed.

GEOGRAPHICAL SURVEYS OF THE TERRITORY OF THE UNITED STATES WEST OF THE ONE HUNDREDTH MERIDIAN.

Officer temporarily in charge, First Lieut. M. M. Macomb, Fourth U. S. Artillery.

Capt. George M. Wheeler, Corps of Engineers, in charge after his return from Europe as commissioner to Third International Geographical Congress from January 1, 1883, to June 15, 1883, was engaged during the last part of the calendar year of 1882 in the preparation of a report upon the "Geographical Congress and Exhibition," which includes also considerable official data concerning the great topographical surveys of Europe and of India, which has been submitted to the Department, and will be transmitted to Congress with request that it be printed. In consideration of the scope which it has been possible for Captain Wheeler to give this report (relating to the origin, organization, functions, history, and progress of the topographical surveys of the civilized nations) it would appear that this information will prove of value and general interest, therefore its reproduction in quarto form (rendered necessary on account of the character of its illustrations) is recommended, and in such numbers as will permit of an extended distribution.

Work during the year has been entirely confined to the office. It has consisted mainly in reducing unplotted notes, constructing and drawing the final maps, preparation of data for unpublished reports, and in distribution of maps and reports. Three plotting sheets and four final atlas sheets were completed, with two atlas sheets in hand approaching completion. It is estimated that the map work will be closed out in November, and that the reports will be submitted for printing before that time. On closing the work there will be thirteen new sheets of value and interest ready for publication, besides other maps for which there is a demand, and of which the first editions have been exhausted.

The remaining funds are only sufficient to permit of the completion of the originals mentioned and not of their reproduction, nor of that of

earlier atlas sheets, the editions of which are exhausted. Lieutenant Macomb estimates that two thousand dollars would cover the expenses of an edition sufficient to supply immediate wants.

(See Appendix U U.)

RECONNAISSANCES AND EXPLORATIONS.

The following-named officers have been on duty at the headquarters of the Army and at headquarters of the military divisions and departments, and have been engaged during the year in preparing such maps and making such surveys and reconnaissances as were required by their respective commanding officers:

Lieut. Col. O. M. Poe (colonel and aid-de-camp to the General of the Army).

Capt. James F. Gregory (lieutenant-colonel and aid-de-camp to the Lieutenant-General).

Capt. W. R. Livermore at headquarters Department of Texas.

Lieut. Dan C. Kingman at headquarters Department of the Platte.

Lieut. T. N. Bailey at headquarters Department of the Missouri until November 9, 1882, and Lieut. O. M. Carter at same headquarters since that date.

Capt. Edward Maguire at headquarters Department of Dakota until September 5, 1882, and Lieut. H. S. Taber at same headquarters since that date.

Maj. W. A. Jones at headquarters Division of the Pacific.

Lieut. G. J. Fiebeger at headquarters Department of Arizona.

Lieut. T. W. Symons at headquarters Department of the Columbia until November 21, 1882, and Lieut. G. W. Goethals at same headquarters since that date.

Capt. James F. Gregory, Corps of Engineers, lieutenant-colonel and aid-de-camp, on duty at headquarters Military Division of the Missouri, reports that no field work was in progress during the year, and that office work has consisted in collecting, compiling, and plotting geographical information for the improvement of existing maps, making reductions, enlargements, and copies of maps of military reservations, posts, scouts, reconnaissances, &c., for use at headquarters, for file, and forwarding.

A report of a tour of inspection with Lieutenant-General Sheridan through Northwestern Wyoming and Eastern Montana, July 10 to September 3, 1882, was made to the Lieutenant-General, and printed with his report.

(See Appendix V V.)

Lieut. Dan C. Kingman, Corps of Engineers, on duty at headquarters Department of the Platte, reports that the work of his office has consisted in determining the latitude and longitude of the proposed site of Fort Thornburgh in Ashley Valley, Utah, and surveying a reservation for the post; also a reservation for wood and timber; surveying route from Fort Bridger to Fort Thornburgh; making preliminary surveys for water-works at Fort D. A. Russell, Wyo.; surveying and marking the boundaries of the military reservation of Fort Douglas, Utah; making other surveys in and near the city of Omaha; plotting the results of the above surveys, making tracings and photographic copies, and supplying such information and data as called for by the depart-

ment commander; collecting geographical information, and supplying maps, instruments, &c., for use in the department.

(See Appendix W W.)

Lieut. O. M. Carter, Corps of Engineers, on duty at headquarters Department of the Missouri, reports that maps of all the posts and military reservations have been made from previous surveys corrected to date; a topographical map of Southwestern New Mexico has been completed and photolithographed, and a map of the department projected. A survey of the military reservation at Jefferson Barracks, Missouri, and a report concerning the claims of various parties to portions of the reservation has been made. Additional map information has been obtained by the method of trial sheets, inaugurated by Lieutenant Bailey, and New Mexico and Western Colorado have thus been mapped.

Lieutenant Carter appends the report of Capt. H. W. Lawton, Fourth U. S. Cavalry, acting Engineer officer, district of New Mexico.

(See Appendix X X.)

Lieut. H. S. Taber, Corps of Engineers, at headquarters Department of Dakota, states that no funds being available, no reconnaissances, except one in person, of military road from Yankton to Fort Randall have been made. Gives summary of a large amount of tunnel, sewer, road, and topographical work done. Refers to bridge and road in southern part of Dakota which the office is charged with building and improving respectively. Summarizes office work, and refers to the progress made with the blue process as applied to map making. Appends report on military road from Yankton to Fort Randall.

(See Appendix Y Y.)

Maj. W. A. Jones, Corps of Engineers, on duty at headquarters Military Division of the Pacific and Department of California, reports that operations have been carried on under the following classification:

Surveys for military purposes.

The collection of geographical information.

Cartographic work connected with the foregoing.

The distribution of maps and geographical information.

The collation of information obtained by reconnaissances of troops in the field.

The following has been accomplished:

Surveys.

Tree plantation, Presidio Reservation.
1,000 yards rifle range, Presidio.
Line of levels for draining marsh at Fort Winfield Scott, Cal.
600 yards rifle range, Presidio.
100 and 200 yards rifle range, Presidio.
Light battery target-range, Presidio.
New rifle range, Angel Island, Cal.

Examinations and reports.

Conference with senior Engineer officer on Pacific coast concerning proposed name for fort at Fort Point, Cal.
Tree culture, Golden Gate Park.
Tree culture on Presidio Reservation (preliminary).

Conference with United States district attorney, concerning ownership in case of the Rancho Ojo de Agua de Figueroa.

Plan for the cultivation of trees upon the Presidio Reservation.

Report on tree culture at Fort Apache, Ariz.

Conference with General Vallejo, military commandant of California in 1834, concerning military reservations under the Mexican *régime*.

Report on water-pipe line across the military reservation at Monterey, Cal.

Examination in case of proposed street-car extension to Fort Winfield Scott, Cal.

Analysis of Presidio soils, by department of agriculture, University of California.

Report on Army quarters.

Report on Lobos Creek water supply.

Experiments in photography and line production.

Memorandum on fuel equivalents.

Translation of all the title papers in case of Rancho el Corte de Madera del Presidio de San Francisco.

Report on eradication of thistle.

Report on the title in the case of the Rancho el Corte de Madera del Presidio de San Francisco, and the military reservation at Peninsula Island.

Specifications for magazine rifles.

Cartographic.

A considerable number of maps, plans, sketches, and illustrations of military subjects have been prepared.

(See Appendix Z Z.)

Lieut. Gustav J. Fiebeger, Engineer officer at headquarters Department of Arizona, reports the following field work, viz: Reconnaissance across the Black Mesa, July 29 to August 25; survey of White Mountain Indian Reservation (in part); survey of Fort Huachuca Reservation, February, 1883; reconnaissance in Southeastern Arizona, and Mexico, April 2 to June 24, with the general commanding, in his movements against the Chiricahua Indians; and that the office work consisted in the correction of maps, and their reproduction by the blue process, making tracings of latest land surveys, the projection of a new map of Arizona, the compilation of a table of distances in the department, correction of road maps, making maps of posts and reservations, and plans of buildings, &c., and the compilation of maps from his field notes of scout in the Mogollon Mountains and Black Mesa, and General Crook's route from Willcox to the Mexican boundary, and his line of march into Chihuahua and Sonora, and return.

(See Appendix A A A.)

Lieut. George W. Goethals, Engineer officer on duty with the commanding general, Department of the Columbia, since November 22, 1882, reports upon the work done by himself and assistants. He was engaged during the months of March and April, 1883, in examining the country in the vicinity of Fort Colville and Lake Osoyoos, with a view to the correction of the department map. He also examined the country traversed by the Cape Flattery Military Telegraph Line, from Port Townsend to Cape Flattery, Wash., for the purpose of giving instructions regarding the preparation of a map of the territory through which the line is built.

During the month of June of the present year Lieutenant Goethals, under the direction of the department commander, made an extended examination of the country lying along the northern boundary, including the Hudson Bay trail from Lake Osoyoos to Fort Hope, B. C., for the purpose of determining the practicability of establishing and maintaining wagon-roads.

In view of accumulated information regarding the topography of the department, Lieutenant Goethals recommends the issue of a new department map.

(See Appendix B B B.)

ESTIMATE FOR AMOUNT REQUIRED FOR SURVEYS AND RECONNAISSANCES IN MILITARY DIVISIONS AND DEPARTMENTS.

For military surveys and reconnaissances, and surveys of military reservations by the Engineer officers attached to the several headquarters of military divisions and departments, being an average of $5,000 for each of eight military divisions and departments west of the Mississippi River, $40,000; for publication of maps for use of the War Department, $10,000; total, $50,000.

OFFICE OF THE CHIEF OF ENGINEERS.

In the labors of the office the Chief of Engineers was assisted on the 30th of June by the following officers in charge of the several divisions:

Major John M. Wilson, Bvt. Colonel, U. S. A.—

FIRST DIVISION.—*Fortifications and Surveys relating thereto—Armament of Fortifications—Sites for Engineer Defenses—Boards of Engineers for Defenses.*

SECOND DIVISION.—*Battalion of Engineers—Engineer School of Application, and Engineer Depot and Post—Professional Papers and Information—Personnel—Orders—Military Reservations—Land Files.*

Lieut. Col. John G. Parke, Bvt. Maj. Gen., U. S. A.—

THIRD DIVISION.—*Improvement of Rivers and Harbors and Surveys relating thereto—Bridging Navigable Waters of the United States—Public Buildings and Grounds and Washington Aqueduct.*

Captain Henry M. Adams.—

FOURTH DIVISION.—*Accounts for Disbursements—Returns of Engineer Property and Instruments—Applications for Remittances—Appropriations and Estimates—Blank Forms.*

FIFTH DIVISION.—*Survey of the Lakes—Explorations and Surveys—Reconnaissances—Maps—Instruments—Claims.*

Very respectfully, your obedient servant,

H. G. WRIGHT,
Chief of Engineers,
Brig. and Bvt. Major-General.

Hon. ROBERT T. LINCOLN,
Secretary of War.

STATEMENT SHOWING THE RANK AND THE DUTIES OF OFFICERS OF THE CORPS OF ENGINEERS DURING THE FISCAL YEAR ENDING JUNE 30, 1883.

Rank and Name.	Duties.
BRIGADIER GENERAL AND CHIEF OF ENGINEERS.	
Horatio G. Wright..... *Bvt. Major General.*	In command of the Corps of Engineers and in charge of the Engineer Department. Charged with the supervision of such matters connected with construction of jetties and other works at South Pass, Mississippi River, as require the action of the Secretary of War. Member of Joint Commission to supervise the construction of the Washington National Monument. Member of the Lighthouse Board. Directed by the President to coöperate with the authorities of the State of New York in examining and deciding upon exterior pier and bulkhead lines on Hudson River from State dam at Troy to the city of Hudson.
COLONELS.	
Z. B. Tower..... *Bvt. Major General.*	President of The Board of Engineers. Member of Boards of Engineer Officers on improvement of Charleston Harbor, S. C.; on improvement of Pass Cavallo Inlet, Aransas Pass and Bay, and entrance to Galveston Harbor, Tex.; and on improvement of Savannah River and Harbor, Ga. Retired from active service January 10, 1883.
John Newton ..... *Bvt. Major General.*	President of The Board of Engineers. In charge of the improvement of the harbors at New York, Rondout, Port Chester, New Rochelle, and of Echo Harbor, N. Y. In charge of the improvement of the Hudson River, Harlem River, Buttermilk Channel, and channel in Gowanus Bay, Flushing, Sheepshead, and Canarsie bays, Sumpawanus Inlet, and East Chester and Newtown creeks, N. Y., and Cheesequakes Creek, and South and Raritan rivers, N. J.; and removal of obstructions in the East River, including Hell Gate, N. Y. In charge of the manufacture and supply of Mastic, and examination of Brooklyn Bridge, N. Y. In charge of the removal of wreck lying below Sing Sing, Hudson River. In charge of preliminary examination or survey of Gowanus and Minisceongo creeks, and Saugerties and Peekskill harbors, N. Y. Member of Boards of Engineer Officers on improvement of Charleston Harbor, S. C.; on improvement of Pass Cavallo Inlet, Aransas Pass and Bay, and entrance to Galveston Harbor, Tex.; on improvement of Savannah River and Harbor, Ga.; to examine candidates for promotion in the Corps of Engineers, and of Court of Inquiry upon Lieutenant Colonel Warren's conduct as Major General commanding the Fifth Army Corps at battle of Five Forks, Va., on April 1, 1865. Member of a joint Board of Army and Navy officers upon plans and location of a bridge over Thames River at New London, Conn. Directed by the President to coöperate with the authorities of the State of New York in examining and deciding upon exterior pier and bulkhead lines on Hudson River from State dam at Troy to the city of Hudson.
George Thom..... *Bvt. Brig. General.*	In charge of the improvement of the harbors at Belfast, Portland, Rockland, Richmond (Kennebec River), Me., Portsmouth, N. H., Newburyport, Lynn, and Boston (including sea-walls on Point Allerton, Great Brewster Island, Lovells' Island, Long Island Head, Rainsford Island, and Deer

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
COLONELS. (continued.)	Island; also channel leading to Nantasket Beach), Plymouth, Provincetown, and Scituate, Mass. In charge of the improvement of the rivers Saint Croix (repairing breakwater near Calais), Cathance, Back (at "Gut" opposite Bath), Royal, and Kennebunk, Me., Lamprey, Exeter, and Cocheco, N. H., Merrimac, Malden, Mystic, and Charles, Mass., Lubec Channel, and Moose-a-bec Bar at Jonesport, Me., and of Lake Winnipiseogee, N. H. In charge of preliminary examination or survey of Androscoggin River below Brunswick; Penobscot River and Bangor Harbor, Me.; Boston Harbor, headland in town of Hull, at entrance to Boston Harbor; Ipswich River and Sandy Bay, at end of Cape Ann, Mass.; for extension and completion of breakwater, near the third bridge, in Portsmouth Harbor, N. H., connecting Goat Island and New Castle; at and near mouth of Great Bay, with view to increasing depth of flow of water and improvement of navigation of Piscataqua River and its tributaries; Sandy Bay and Rockport, Mass., with view to construction of a breakwater for harbor of refuge; and of resurvey of breakwater at mouth of Saco River, Me. Retired from active service February 20, 1883.
William F. Raynolds---- *Bvt. Brig. General.*	Member of Board of Engineer Officers on claims of Charles McCafferty and D. and C. P. Dull, as provided for by River and Harbor act of August 2, 1882. Engineer 4th Lighthouse District.
Charles S. Stewart ------	In charge of the construction of Fort Winfield Scott, and batteries at Fort Mason, and Fortifications at Angel Island, in San Francisco Bay, and at San Diego, Cal. In charge of the improvement of the harbor at San Diego, Cal. Member of Boards of Engineer Officers to examine candidates for promotion in the Corps of Engineers, and on improvement of mouth of the Columbia River, Oreg., and Member of Board of Officers to examine disabled officers with view to retirement. Senior Member of Board of Engineers for the Pacific Coast.
Charles E. Blunt -------	In charge of the construction of forts Gorges, Preble, Scammel, Popham, Knox, and Battery at Portland Head, Me., and forts Constitution and McClary, and batteries on Jerry's Point and Gerrish's Island, Portsmouth Harbor, N. H., and of forts Winthrop, Independence, and Warren; work on Long Island Head, and field works on the coast from Provincetown to Gloucester, Mass. Engineer 1st and 2d Lighthouse districts. In charge of the improvement of the harbors at Belfast, Portland, Rockland, Richmond (Kennebec River), Me., and Portsmouth, N. H. In charge of the improvement of the rivers Cathance, Back (at "Gut" opposite Bath), Royal, and Kennebunk, Me., Lamprey and Cocheco, N. H., Lubec Channel, and Moose-a-bec Bar at Jonesport, Me., and of Lake Winnipiseogee, N. H. In charge of preliminary examination or survey of Penobscot River and Bangor Harbor, Me.; at and near mouth of Great Bay, with view to increasing depth of flow of water and improvement of navigation of Piscataqua River and its tributaries; and of resurvey of breakwater at mouth of Saco River, Me.
James C. Duane -------- *Bvt. Brig. General.*	On detached service; Engineer 3d Lighthouse District.

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
COLONELS. (continued.)	
Quincy A. Gillmore ----- *Bvt. Major General.*	In charge of the construction of forts Wadsworth, Tompkins and its batteries, N. Y., Monroe and Wool, Va., Macon and Caswell, N. C., Moultrie, Sumter, and Johnson, and Castle Pinckney, S. C., forts Jackson and Pulaski, Ga., and Clinch and Marion, Fla. In charge of the improvement of the harbors at Charleston, S. C., and Savannah and Brunswick, Ga. In charge of the improvement of Ashley River and Wappoo Cut, S. C.; of the bar at the mouth of St. John's River, and of the inside passage between Fernandina and St. John's, Fla., Volusia Bar, Fla., Cumberland Sound, Ga. and Fla., Savannah and Altamaha rivers, St. Augustine Creek, and Romley Marsh, Ga., and Edisto and Salkahatchie rivers, S. C. To remove wreck of Steamer Maple Leaf from channel of St. John's River, Fla. In charge of preliminary examination or survey of channel of St. John's River at its entrance into and exit out of Lake Monroe, and between Lakes George and Monroe; and of the north end of Indian River and Mosquito Lagoon, Fla. The above duties in temporary charge of Captain Post. Member of Boards of Engineer Officers on improvement of Charleston Harbor, S. C.; on improvement of Pass Cavallo Inlet, Aransas Pass and Bay and entrance to Galveston Harbor, Tex.; on improvement of Savannah River and Harbor, Ga.; on further improvement of Cape Fear River, N. C., and on improvement of the Potomac River near Washington, D. C. Member and President of "The Mississippi River Commission" created by Act of Congress approved June 28, 1879.
LIEUTENANT-COLONELS.	
Thos. Lincoln Casey----- *Bvt. Colonel.*	In charge of the construction of the building for the State, War, and Navy departments; of the Washington Aqueduct, the construction of the Washington National Monument, and of the improvements over the grave of Thomas Jefferson, at Monticello, Va., and of the erection of a monument at Washington's Headquarters, at Newburg, N. Y.
John G. Parke --------- *Bvt. Major General.*	In charge of the 3d Division, Office of the Chief of Engineers.
Gouverneur K. Warren-- *Bvt. Major General.*	In charge of the construction of defenses of New Bedford Harbor, Mass., and Narragansett Bay, R. I. In charge of the improvement of the harbors of Nantucket, Hyannis, Wareham, and Wood's Holl, Mass., Newport and Block Island, R. I. In charge of the improvement of the Rivers Taunton, Mass., Pawtucket, Providence, and Potowomut, R. I., and Connecticut, Mass. and Conn.; Narragansett Bay, R. I., and Little Narragansett Bay, R. I. and Conn. Member of Board of Engineer Officers upon bridging the Ohio River. Died August 8, 1882.
George H. Mendell------ *Bvt. Colonel.*	In charge of the construction of Fort on Alcatraz Island, and of defenses at Lime Point, San Francisco Bay. In charge of the improvement of the Harbor at Oakland, Humboldt Harbor and Bay, and of the construction of the breakwater at Wilmington Harbor, Cal. In charge of the improvement of Sacramento and San Joaquin Rivers and Petaluma Creek, Cal. To investigate causes tending to decrease

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
LIEUTENANT-COLONELS. (continued.)	depth of water and diminish the commercial value of San Francisco Harbor. In charge of preliminary examination or survey of Alameda Creek, Santa Monica Bay, Redwood Slough, and Clear Lake, Cal. In charge of the removal of wreck of steamer Escambia from entrance to San Francisco Harbor, Cal. Member of Board of Engineers for the Pacific Coast. Member of Boards of Engineers for the examination of officers for promotion in the Corps of Engineers and on improvement of the mouth of the Columbia River, Oreg.
Henry L. Abbot ..... *Bvt. Brig. General.*	Member of The Board of Engineers. In charge of the construction of Fort Schuyler and fort at Willets Point, N. Y., and of experiments with torpedoes. Commanding Engineer Depot and Post of Willets Point, Engineer School of Application, and Battalion of Engineers. Member of Boards of Engineer Officers to examine candidates for promotion in the Corps. Member of joint Gun Foundry Board of Army and Navy officers.
William P. Craighill	In charge of the construction of defenses of Baltimore, Md., and Washington, D. C. In charge of the improvement of the harbors at Baltimore, Annapolis, Queenstown, and of the inner-harbor at Cambridge, Md., and Onancock Harbor, Va. In charge of the improvement of the channel of Susquehanna River above and below Havre de Grace, and work at the Fishing Battery light station near Spesutia Island; of the Chester, Wicomico, Pocomoke, Elk, Northeast, and Choptank Rivers, Treadhaven, Secretary, and Corsica creeks, and water-passage between Deil's Island and Little Deil's Island, and upper thoroughfare at Deil's Island, Md.; Broad Creek, Del., James and Appomattox rivers, Va., New River, Va. and W. Va., Great Kanawha, Shenandoah, and Elk rivers, W. Va., and Cape Fear River, N. C. In charge of the surveys across the peninsula of Maryland and Delaware to connect by canal the waters of the Delaware and Chesapeake bays. In charge of the building of the monument at Yorktown, Va. In charge of preliminary examination or survey of Pocomoke River, Md.; Monokin River from its mouth to Princess Anne; Wicomico River from its mouth to Salisbury; Pungoteague Creek from Bogg's Wharf to the Warehouse; Hunting and Cherrystone creeks, Va.; Dividing and Wetipkin creeks, Md.; Isle of Wight and upper Synepuxent Bay, Md., and Indian River, Del., with the intervening land, with view to connecting their waters. Member of Boards of Engineer Officers on further improvement of Cape Fear River; on improvement of the Potomac River near Washington, D. C.; on improvement of the mouth of the Columbia River, Oreg., and on bridge over the Ohio River near Beaver, Pa.
Cyrus B. Comstock ..... *Bvt. Brig. General.*	Member of The Board of Engineers. In charge of the survey of Northern and Northwestern Lakes. Member of Boards of Engineer Officers on further improvement of Cape Fear River; on improvement of the Potomac River near Washington, D. C.; on improvement of the mouth of the Columbia River, Oreg, and for the examination of officers for promotion in the Corps of Engineers. Member and President of "The Mississippi River Commission" created by Act of Congress approved June 28, 1879.

Statement showing rank and duties of officers of Corps of Engineers—Cont'd

Rank and Name.	Duties.
LIEUTENANT-COLONELS. (continued.)	
Godfrey Weitzel *Bvt. Major General.*	In charge of the construction of harbor of refuge on Lake Huron. In charge of the Louisville and Portland Canal and of St. Mary's Falls Canal; of the improvement of the Falls of the Ohio, St. Mary's Falls Canal, and of the rivers St. Mary and Detroit, Mich. In charge issuing of charts of Northern and Northwestern Lakes, and the water level observations on Lake Huron. In charge of the removal of wreck of steamer Nile from Detroit River. Member of Board of Engineer Officers upon bridging the Ohio River; of Board of Engineer Officers on bridge over the Ohio River near Beaver, Pa. Engineer 11th Lighthouse District. In charge of the construction of forts Delaware, Del., and Mifflin, Pa., battery at Finn's Point, N. J., and work opposite Fort Delaware, Del. In charge of the improvement of the harbors at Wilmington, Del., Chester, Pa., Delaware Breakwater; ice-harbors at Marcus Hook, Pa.; New Castle, Del.; and the head of Delaware Bay; and removal of sunken piers in channel back of Reedy Island; and of the construction of pier near Lewes, Del.; of the Salem, Rancocas, Maurice, and Raccoon rivers, Cohansey, Mantua, and Woodbury creeks, N. J.; Delaware, Christiana, Broadkiln, Indian, and St. Jones rivers, Duck and Mispillion creeks, Del.; Chester and Frankford creeks, Schuylkill River, Susquehanna River from Richard's Island up, and north branch of the Susquehanna River, Pa.; Delaware River below Bridesburg, Pa.; between Bridesburg and Trenton; near Cherry Island Flats; and at Schooner Ledge. In charge of the examination or survey of Delaware River, of Five Mile Point below Bridesburg on the Delaware River, and the harbor at the Delaware breakwater and the entrance thereto. In charge of preliminary examination or survey of Newton and Pensaukin creeks, N. J.; Delaware River above and in front of Philadelphia, and between Trenton, N. J., and Port Jervis, N. Y.; North branch of the Susquehanna River, from Pittston to Athens; the river Brandywine from its mouth to the Market street bridge in Wilmington; and Leipsic River, Del., from Delaware River to the town of Leipsic. Chairman of Commission Advisory to Board of Harbor Commissioners of Philadelphia, Pa. To take steps for removal of wreck of schooner Trade Wind from mouth of Maurice River, N. J.
Orlando M. Poe *Bvt. Brig. General.*	On detached service; Aide-de-Camp on the personal staff of the General of the Army with the rank of Colonel. Member of Lighthouse Board.
David C. Houston *Bvt. Colonel.*	In charge of the improvement of the harbors at Milwaukee, Racine, and Kenosha, Wis., and Waukegan, Ill., and harbor of refuge at Milwaukee Bay, Wis. In charge of the improvement of the rivers Fox and Wisconsin. In charge of water level observations on Lake Michigan. In charge of preliminary examination or survey of Wisconsin River from Portage to Merrill. Member of Boards of Engineer Officers on matters relating to Sturgeon Bay and Lake Michigan Ship Canal, Wis.; on modification of cribs to be used in piers at harbors of Pentwater and Frankfort; on dam at outlet of Lake Winnibigoshish on the Mississippi River; concerning the channel of the Lower Fox River between

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
LIEUTENANT-COLONELS. (continued.)	Lake Winnebago and upper Government dam at Appleton, and to dam at Menasha and Appleton; and on examination of Calumet River, Ill., and on improvement of the Kentucky River.
George H. Elliot	In charge of the 1st and 2d Divisions, Office of the Chief of Engineers. In charge of the construction of defenses of New Bedford Harbor, Mass., and Narragansett Bay, R. I. In charge of the construction of harbor of refuge at Wood's Holl, Mass. In charge of the improvement of the harbors of Nantucket, Wood's Holl, Wareham, Hyannis, Provincetown, Plymouth, and Scituate, Mass., Newport and Block Island, R. I., and Stonington, Conn. In charge of the improvement of the rivers Taunton, Mass., Pawtucket, and Providence, R. I., and Connecticut, Mass. and Conn., Narragansett Bay, R. I., and Little Narragansett Bay, R. I. and Conn. In charge of survey of Pawtucket River, R. I. Member of joint Board of Army and Navy officers upon plans and location of a bridge over Thames River at New London, Conn.
Henry M. Robert	In charge of the improvement of the Harbors at Ontonagon, Eagle Harbor, Marquette, Manistique, Cedar River, Mich., Menomonee, Green Bay, Ahnepee, Two Rivers, Manitowoc, Sheboygan, Port Washington, Kewaunee, Pensaukee, and Oconto, Wis.; and harbors of refuge at entrance to Sturgeon Bay Canal, Lake Michigan, and at Grand Marais, Mich. In charge of water level observations on Lake Superior. Advisory Engineer for improvement of Kewaunee Harbor, Wis. Member of Boards of Engineer Officers on matters relating to Sturgeon Bay and Lake Michigan Ship Canal, Wis.; concerning the channel of Lower Fox River between Lake Winnebago and upper government dam at Appleton, and to dam at Menasha and Appleton; on improvement of Saginaw River, Mich.; and on dam at outlet of Lake Winnibigoshish on Mississippi River. In charge of the construction of Fort Wayne, Mich., and forts Porter, Niagara, Ontario, and Montgomery, N. Y. In charge of the improvement of the harbors at Buffalo on Lake Erie, Wilson, Olcott, Oak Orchard, Charlotte, Pultneyville, Big Sodus, Little Sodus, Oswego, and Sacketts, on Lake Ontario, and Ogdensburg and Waddington, on the river St. Lawrence, Plattsburg, N. Y., and Burlington and Swanton, on Lake Champlain. In charge of the improvement of Niagara, Ticonderoga, and Grass rivers, N. Y., and Otter Creek, Vt. In charge of examination or survey for breakwater at Rouse's Point on Lake Champlain. In charge of water-level observations on Lake Ontario. To take steps for removal of portion of wreck of Schooner Falmouth from Buffalo Harbor, N. Y.
William E. Merrill. *Bvt. Colonel.*	In charge of the improvement of the Ohio River; the Falls of the Ohio; the Louisville and Portland Canal, and harbor of refuge near Cincinnati, Ohio. In charge of the improvement of the Monongahela River, W. Va. and Pa.; of the Allegheny River, Pa., and of the construction of an ice-harbor at the mouth of Muskingum River, Ohio. In charge of preliminary examination or survey of the Youghiogheny River from McKeesport to Connellsville; Tionesta Creek, Pa.; Ohio River at Rochester and Freedom, Pa., for ice-breakers; ice-harbor at Middleport, Ohio; for excavating

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
LIEUTENANT-COLONELS. (continued.)	a channel through the Grand and Little Chains in the Ohio River; and Taggert's Valley River, W. Va., above Grafton to Three Forks of Buckhannon. Member of Board of Engineer Officers upon bridging the Ohio River; upon bridging the Ohio River near Beaver, Pa., and on improvement of Kentucky River. Engineer 14th Lighthouse District. In temporary charge of the improvement of the Little Kanawha and Guyandotte rivers, W. Va., the Big Sandy River, W. Va. and Ky., and the Kentucky and Tradewater rivers, Ky.
MAJORS.	
Walter McFarland	In charge of the construction of Fort Wayne, Mich., and forts Porter, Niagara, Ontario, and Montgomery, N. Y. In charge of the improvement of the harbors at Dunkirk and Buffalo on Lake Erie, Olcott, Oak Orchard, Charlotte, Pultneyville, Big Sodus, Little Sodus, Oswego, Sacketts, and Wilson, on Lake Ontario, and Ogdensburg and Waddington, on the river St. Lawrence, Plattsburg, N. Y., and Burlington and Swanton, on Lake Champlain. In charge of the improvement of Niagara, Ticonderoga, and Grass rivers, N. Y., and Otter Creek, Vt. In charge of preliminary examination or survey of Champlain River from the lake up to Champlain Town; for breakwater at Rouse's Point; harbors of Port Henry and Port Marshall, on Lake Champlain, and Boquet River, N. Y. In charge of water-level observations on Lake Ontario. Member of Board of Engineer Officers on claims of Charles McCafferty and D. and C. P. Dull, as provided for by River and Harbor act of August 2, 1882. In charge of forts Griswold and Hale, and the construction of Fort Trumbull, Conn. In charge of the improvement of the harbors of New London, New Haven, Bridgeport, Milford, Clinton, Southport, and Norwalk, Conn., and Port Jefferson, Greenport, and Mamaroneck, N. Y., and of the construction of Breakwater at New Haven, Conn. In charge of the improvement of the rivers Housatonic and Thames, Conn., and Connecticut, Mass. and Conn. In charge of examination or survey of harbors of Norwalk, Black Rock, Stamford, Westport, and Branford, Conn., and Southold, and channel-way of Peconic River entering Peconic Bay, and channel-way from Riverhead to Great Peconic Bay, N. Y. To remove wrecks from harbors at New Haven and Bridgeport, Conn. Member of joint Board of Army and Navy officers upon plans and location of a bridge over Thames River at New London, Conn.
Orville E. Babcock *Bvt. Brig. General.*	On detached service; Engineer 5th and 6th Lighthouse Districts.
John M. Wilson *Bvt. Colonel.*	In charge of the improvement of the harbors at Port Clinton, Monroe, Toledo, Sandusky, Huron, Vermillion, mouth of Black River, Rocky River, Cleveland, Fairport, Ashtabula, Conneaut, and Erie, on Lake Erie. In charge of the improvement of Sandusky River, Ohio. In charge of water-level observations on Lake Erie. In charge of preliminary examination or survey of channel known as Old River Bed, leading from Cuyahoga River to harbor of refuge at Cleveland, Ohio. In charge of the 1st and 2d Divisions, Office of the Chief of Engineers.
Franklin Harwood *Bvt. Lieut. Colonel.*	In charge of the improvement of the harbors at Cheboygan, Au Sable, and Sebewaing, on Lake Huron, and harbor of

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
MAJORS. (continued.)	
	Alpena at Thunder Bay. In charge of the improvement of Saginaw and Clinton rivers, Mich., and removing bar at ice-harbor of refuge at Belle River, Mich. In charge of St. Clair Flats Canal. In charge of preliminary examination or survey of Harbor at Caseville, and resurvey of Sebewaing Harbor, Mich. In charge of the improvement of the harbors at Wareham, Hyannis, Provincetown, Plymouth, and Scituate, Mass. Died March 26, 1883.
John W. Barlow--------- *Bvt. Lieut. Colonel.*	In charge of forts Griswold and Hale, and the construction of Fort Trumbull, Conn. In charge of the improvement of the harbors of New London, Stonington, New Haven, Bridgeport, Milford, Clinton, Southport, and Norwalk, Conn., and Port Jefferson, Greenport, and Mamaroneck, N. Y., and of the construction of Breakwater at New Haven, Conn. In charge of the improvement of the rivers Housatonic and Thames, Conn. In charge of preliminary examination or survey of harbors of Norwalk, Madison, Duck Island, with view to the construction of short breakwater for harbor of refuge, Black Rock, Stamford, Westport, and Branford, Conn., and Southold and Stoney Brook, and channel-way of Peconic River, entering Peconic Bay, and channel-way from Riverhead to Great Peconic Bay, N. Y. To remove wrecks from harbors at New Haven and Bridgeport, Conn. In temporary charge of the construction of defenses of New Bedford Harbor, Mass., and Narragansett Bay, R. I.; improvement of the Harbors of Nantucket, Hyannis, Wareham, and Wood's Holl, Mass., Newport and Block Island, R. I.; improvement of the rivers Taunton, Mass., Pawtucket, Providence, and Potowomut, R. I., and Connecticut, Mass. and Conn.; Narragansett Bay, R. I., and Little Narragansett Bay, R. I. and Conn. In temporary charge of preliminary examination or survey of Connecticut River from Bellows Falls, Vt., to Pittsburgh, N. H.; Pawtucket River, Pawtuxet Harbor, and Bissell's Cove, R. I. In charge of the improvement of the harbors at Ontonagon, Eagle Harbor, Marquette, Manistique, Cedar River, Mich., Menomonee, Green Bay, Ahnepee, Two Rivers, Manitowoc, Sheboygan, Port Washington, Kewaunee, Pensaukee, and Oconto, Wis.; and harbors of refuge at entrance to Sturgeon Bay Canal, Lake Michigan, and at Grand Marais, Mich. In charge of water-level observations on Lake Superior. Advisory Engineer for improvement of Kewaunee Harbor, Wis.
Peter C. Hains--------- *Bvt. Lieut. Colonel.*	On detached service; Engineer 6th Lighthouse District. In charge of forts Foote and Washington, Md. In charge of the improvement of the harbors at Washington and Georgetown, D. C. In charge of the improvement of the Potomac River in the vicinity of Washington, the establishment of the harbor lines, and the raising of the river flats.
Francis U. Farquhar---- *Bvt. Lieut. Colonel.*	On detached service; Engineer Secretary to Lighthouse Board. In charge of the improvement of the harbors at Cheboygan, Au Sable, and Sebewaing on Lake Huron, and Alpena at Thunder Bay, and of the construction of harbor of refuge on Lake Huron; of the improvement of the St. Mary's Falls Canal, and of the Rivers St. Mary, Detroit,

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
MAJORS. (continued.)	Saginaw, and Clinton, Mich.; of removing bar at ice-harbor of refuge at Belle River, Mich.; Hay Lake Channel of the St. Mary's River; and construction of dry dock, St. Mary's Falls Canal. In charge of removal of wreck of steamer Nile from Detroit River. In charge of St. Clair Flats Canal and St. Mary's Falls Canal, Mich. In charge of issuing charts of Northern and Northwestern Lakes, and of water-level observations on Lake Huron. In charge of preliminary examination or survey of Harbor at Caseville, Mich., and resurvey of Sebewaing Harbor, Mich. Member of Board of Engineer Officers on improvement of Saginaw River, Mich. In charge of the Louisville and Portland Canal, and of improvement of the Falls of the Ohio.
George L. Gillespie ----- *Bvt. Lieut. Colonel.*	In charge of the improvement of the harbors of Plattsburgh, N. Y., Burlington and Swanton, Vt., and of the Ticonderoga River, N. Y., and Otter Creek, Vt. In charge of the construction of forts Columbus, Wood, and Hamilton, and additional batteries, Castle Williams, South Battery and sea wall at Governor's Island, Mortar Battery at Fort Hamilton, N. Y., and fort at Sandy Hook, N. J. In charge of the improvement of Keyport Harbor, N. J. In charge of the improvement of the Shrewsbury, Rahway, Elizabeth, Manasquan, and Passaic Rivers, Raritan Bay, and Woodbridge, Cheesequakes, and Mattawan creeks, N. J.; Flushing, Sheepshead, and Canarsie bays, Sumpawanus Inlet, and East Chester and Newton creeks, N. Y., and channel between Staten Island and New Jersey. In charge of the removal of the wrecks of bark Samarang, near Sandy Hook, N. J., and of steamer Nankin at entrance to New York Harbor. In charge of the examination or survey between City Island and New Rochelle Harbor, N. Y., including channel around Glen Island. In charge of preliminary examination or survey from Deal to Seabright, on the New Jersey Coast, with view to build a breakwater to protect the shore and harbor at Long Branch; Passaic River between Passaic and Paterson, N. J.; channel from Pearsall's Dock to Flat Creek, N. Y.; North River in front of Jersey City and Hoboken, N. J.; Newtown Creek, N. Y.; and of Shoal Harbor and Compton's Creek, N. J. Member of Boards of Engineer Officers to examine candidates for promotion in the Corps of Engineers, and on claims of Charles McCafferty and D. and C. P. Dull, as provided for by River and Harbor act of August 2, 1882. To represent the General Government in the arrangement for, and the erection of, a pedestal to be built to receive the colossal bronze statue of Liberty Enlightening the World, to be erected upon Bedloe's Island, N. Y. H.
Charles R. Suter--------	In charge of the improvement of the rivers Mississippi and Missouri—removal of snags, &c.; and of the Missouri River from its mouth to Sioux City, and at the following localities: St. Charles, Cedar City, Glasgow, Lexington, Kansas City, Fort Leavenworth, Atchison, St. Joseph, Brownville, Nebraska City, Eastport, Plattsmouth, Omaha, Council Bluffs, Sioux City, Vermillion, and from Kansas City to its mouth; and of Gasconade River. In charge of the survey of the Missouri River from its mouth to Sioux City, Iowa, and to Fort Benton, Mont. Member of "The Mississippi River Commission," created by Act of Congress approved June 28,

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
MAJORS. (continued.)	1879. Member of Board of Engineer Officers at St. Louis, Mo., to examine Captain Jones for promotion in the Corps. Engineer 15th Lighthouse District.
Jared A. Smith	In charge of the improvement of the harbors at Michigan City, Ind., and New Buffalo, Mich. In charge of the improvement of the rivers Wabash, Ind. and Ill., and White, Ind. In charge of preliminary examination or survey of the stone formation in the Kankakee River at Momence, Ill., with view to its removal. Member of Boards of Engineer Officers on modification of Cribs to be used in piers at harbors of Pentwater and Frankfort, and on the examination of the Calumet River, Ill.
Samuel M. Mansfield *Bvt. Lieut. Colonel.*	In charge of the improvement of the harbors at Galveston and Brazos Santiago, Tex. In charge of the improvement of ship channel in Galveston Bay, Pass Cavallo, Aransas Pass and Bay up to Rockport and Corpus Christi, Brazos River, Buffalo Bayou, deepening channel at mouth of Trinity River, and removal of obstructions to Liberty, and the protection of river bank at Fort Brown, Tex. In charge of the examination or survey from Brazos de Santiago through Laguna Madre to Point Isabel, Tex. Member of Board of Engineer Officers on further prosecution of work in connection with dredged channel through Galveston Bay.
William R. King	In charge of the improvement of the rivers Tennessee, Tenn. and Ala., Cumberland above and below Nashville, Ky. and Tenn., Red, Hiwassee, Caney Fork, Obey's, Duck, French Broad, Clinch, and Little Tennessee, Tenn., South Fork ot the Cumberland, Ky., Oostenaula, Coosawattee, Etowah, Oconee, and Ocmulgee, Ga., and Coosa, Ga. and Ala. In charge of preliminary examination or survey of Cumberland River and its principal tributaries above Pineville, Ky., and for placing locks and dams on Cumberland River from Nashville, Tenn., to the Cincinnati Southern Railroad in Kentucky. Member of Board of Engineer Officers on improvement of the Kentucky River.
Wm. H. H. Benyaurd	In charge of improvement of the harbors at Chicago and Calumet, Ill. In charge of the improvement of the Illinois River. In charge of survey of the Hennepin Canal, and for enlargement of the Illinois and Michigan Canal. In charge of preliminary examination or survey of Sangamon River, Ill., from its mouth to Petersburgh; Illinois and Des Plaines rivers between La Salle and Joliet, Ill.; and Calumet River, Ill. and Ind. Member of Boards of Engineer Officers on modification of cribs to be used in piers at harbors of Pentwater and Frankfort; concerning channel of Lower Fox River between Winnebago and the upper government dam at Appleton, and to dam at Menasha and Appleton; and on examination of the Calumet River, Ill.
Garret J. Lydecker	In charge of the Washington Aqueduct and the extension thereof. Engineer Commissioner of the District of Columbia.
Amos Stickney	In charge of the construction of forts Jackson, St. Philip, Livingston, Pike, and Macomb, Tower Dupré, Battery Bienvenue, and tower at Proctorsville, La. In charge of the

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

Rank and Name.	Duties.
MAJORS. (continued.)	improvement of the Harbor at New Orleans, La. In charge of the improvement of the Amite, Vermillion, Tangipahoa, Tickfaw, Tchefuncte, Bogue Falia, and Calcasieu rivers, and the Mississippi River at Natchez and Vidalia; bayous Terrebonne, Teche, Black, and Courtableau, Calcasieu Pass, and of mouth of the Red River, La., Pearl River, Miss., and of removal of obstructions in Bayou La Fourche, La. In charge of Fourth District of the Mississippi River, from Warrenton to Head of the Passes, for the purpose of improvement and construction and repair of levees, to include levees and special work on the river, and the rectification of the Red and Atchafalaya rivers at mouth of Red River. In charge of the examination or survey of Grand Lake, Bogue Chitto River from its mouth to Franklinton, and Bogue Falia from its mouth to 25 miles above Covington, La., and West Pearl River; Pass Manchac and Bayou Manchac, La., from its mouth to the Mississippi River. In charge of preliminary examination or survey of Atchafalaya River between Berwick's Bay and the Gulf of Mexico; Pearl River, Miss., above Carthage, Natalbany River, Bayou La Fourche, and Petit Anse Bayou, La., and water-route to connect Calcasieu River with Sabine Pass. To take necessary steps for removal of wreck in Pass Marianne, Mississippi Sound. Member of Board of Engineer Officers on building and repair of levees on the Mississippi River.
James W. Cuyler -------	In charge of the improvement of the Little Kanawha and Guyandotte rivers, W. Va., and the Big Sandy River, W. Va. and Ky., and the Kentucky and Tradewater rivers, Ky. In charge of extending the survey of the Louisa Fork of the Big Sandy River to Grundy Court-House, Va. Died at Philadelphia, Pa., April 16, 1883.
Alexander Mackenzie ---	In charge of the improvement of the harbors at Fort Madison, Burlington, and Muscatine, Iowa, Rock Island and Galena, Ill. In charge of the improvement of the Mississippi River, from St. Paul to the mouth of the Illinois River; at Quincy, Quincy Bay, and Andalusia, Ill.; at Hannibal, Louisiana, and Alexandria, Mo.; and at Rush Chute, Iowa; and of the upper Mississippi River and Rock Island Rapids and Des Moines Rapids of the Mississippi River; Galena and Cuivre rivers; and of removing bars in Mississippi River opposite Dubuque and Guttenberg, Iowa. In charge of the construction of a dry dock at the Des Moines Rapids Canal; of ice-harbor at Dubuque, Iowa, and of harbors of refuge on Lake Pepin at Stockholm, Wis., and Lake City, Minn. In charge of operating the Des Moines Rapids Canal. In charge of preliminary examination or survey of Iowa River from Wapello to its mouth, and Pecatonica River from Argyle to Wayne, Wis. Member of Boards of Engineer Officers on dam at outlet of Lake Winnibigoshish on the Mississippi River, and on bridge over the Arkansas River at Van Buren, Ark.
Oswald H. Ernst--------	In charge of the improvement of Mississippi River between the mouths of the Illinois and Ohio rivers, opposite St. Louis, and at Cape Girardeau, Mo., and Minton's Point, Ill., and of Osage River in Missouri and Kansas. In charge of improvement of harbor and Mississippi River at Alton.

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

Rank and Name.	Duties.
MAJORS. (continued.)	Member of Board of Engineer Officers on bridge over the Arkansas River at Van Buren, Ark.
David P. Heap	In charge of the improvement of the harbors at Charlevoix, Frankfort, Manistee, Ludington, Pentwater, White River, Muskegon, Grand Haven, Black Lake, Saugatuck, South Haven, St. Joseph, and channel leading up to Benton Harbor, and harbor of refuge at Portage Lake. In charge of the improvement of the Grand River from its mouth to City of Grand Rapids. In charge of preliminary examination or survey of harbor at Cross Village and for harbor of refuge at Ludington, Mich. Member of Board of Engineer Officers on improvement of Saginaw River. On detached service; Engineer Secretary to Lighthouse Board.
William Ludlow *Bvt. Lieut. Colonel.*	In charge of the construction of forts Delaware, Del., and Mifflin, Pa., battery at Finn's Point, N. J., and work opposite Fort Delaware, Del. In charge of the improvement of the harbors at Wilmington, Del., Chester, Pa., and at other places on Delaware River and Bay, ice-harbors at Marcus Hook, Pa., and New Castle, Del., and of the construction of pier near Lewes, Del.; of the Salem and Rancocas rivers and Cohansey Creek, N. J.; Delaware, Christiana, Broadkiln, and St. Jones rivers, Duck and Mispillion creeks, Del.; Chester Creek, Schuylkill River, and Susquehanna River from Richard's Island up, Pa.; and Delaware River below Bridesburg, Pa.; between Bridesburg and Trenton; near Cherry Island Flats, and at Schooner Ledge; of the examination or survey of Five Mile Point below Bridesburg, and Delaware River, harbor at Delaware Breakwater, and ice-harbor at the head of Delaware Bay near Morris Liston's or Reedy Island; Delaware River below League Island, and of the duty to take necessary steps for removal of wreck of steamer Cassandra from Brigatine Shoals, coast of New Jersey. On detached service; Engineer Secretary to the Lighthouse Board. On leave of absence from March 6, 1883, to April 1, 1885, inclusive, under provisions of joint resolution of Congress approved February 28, 1883.
William A. Jones	On detached service; Engineer Officer, Military Division of the Pacific and Department of California.
Andrew N. Damrell	In charge of the construction of defenses of Mobile, Ala., and Pensacola, Fla., and of fort on Ship Island, Miss. In charge of the improvement of the harbors at Pensacola and Key West, Fla., and Mobile, Ala. In charge of the improvement of the rivers Chattahoochee, Appalachicola, Suwanee, Withlacoochee, Manatee, and Caloosahatchee, Fla., Flint, Ga., Alabama, Cahaba, Mobile, and Tallapoosa, Ala., Pascagoula and Noxubee, Miss., Warrior and Tombigbee, Ala. and Miss., Appalachicola and Tampa bays, and Pease Creek, Fla., Escambia and Conecuh rivers, La Grange Bayou, and removal of obstructions in the Choctawhatchee River, Ala. and Fla.; the roadstead leading into Back Bay of Biloxi in Mississippi Sound, and Old Town Creek, Miss. In charge of preliminary examination or survey of harbor at Cedar Keys and St. Mark's River, Fla.; channel inside the shoals along the coast of Florida, from Cedar Keys to Clear Water Harbor and Tampa, Fla.; and shoal between Dauphin Island

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
MAJORS. (continued.)	and Cedar Point, Ala. Member of Board of Engineer Officers on further prosecution of work in connection with dredged channel through Galveston Bay.
Charles J. Allen	In charge of the improvement of the harbors of Duluth, Grand Marais, and Superior Bay, on Lake Superior. In charge of the improvement of the Chippewa River, and protection of sand banks on the same; and of the Minnesota and St. Croix rivers, and the Red River of the North; of the Mississippi River above the Falls of St. Anthony; of the Falls of St. Anthony; construction of Meeker's Island lock and dam, and lock and dam at Goose Rapids on Red River of the North, Minn. and Dak. In charge of the construction of reservoirs at headwaters of the Mississippi River and its tributaries. In charge of the examination and surveys of the sources of the Mississippi, St. Croix, Chippewa, and Wisconsin rivers, with the view to ascertaining the practicability and cost of creating and maintaining reservoirs, &c. In charge of preliminary examination or survey of Minnesota River near Belle Plain; of the source of the Minnesota River near foot of Big Stone Lake, and the lakes near headwaters of Cannon River, Minn., with view to adding same to the reservoir system of the Mississippi River and its tributaries. Member of Board of Engineer Officers on dam at outlet of Lake Winnibigoshish on Mississippi River.
Charles W. Raymond....	Commanding Company A, Battalion of Engineers. Member of General Court Martial to meet at Willet's Point, N. Y., January 3, 1883. In charge of the construction of forts Winthrop, Independence, and Warren, work on Long Island Head, and Field works on the coast from Provincetown to Salem, Mass. In charge of the improvement of the harbors at Newburyport, Lynn, Boston (including sea-walls on Point Allerton, Great Brewster Island, Lovells' Island, Long Island Head, Rainsford Island, and Deer Island; also channel leading to Nantasket Beach), Provincetown, Plymouth, and Scituate, Mass. In charge of the improvement of the rivers Merrimac, Malden, Mystic, and Charles, Mass. In charge of examination or survey of Boston Harbor; headland in town of Hull, at entrance to Boston Harbor; Ipswich River and Sandy Bay, at end of Cape Ann, Mass.; and Sandy Bay, Rockport, Mass., with view to construction of a breakwater for harbor of refuge. Engineer 1st and 2d Lighthouse Districts.
L. Cooper Overman	On duty under the immediate orders of Major King. In charge of the improvement of harbors at Port Clinton, Monroe, Toledo, Sandusky, Huron, Vermillion, mouth of Black River, Rocky River, Cleveland, and Fairport on Lake Erie. In charge of improvement of Sandusky River, Ohio. In charge of water level observations on Lake Erie; and survey or examination of Old River Bed, Cleveland, Ohio.
Alexander M. Miller	In charge of the improvement of the Harbor at Memphis, Tenn. In charge of the improvement of Tensas River, La., Ouachita River and Bayou Bartholomew in La. and Ark., and Bayou Bœuf, La., and Cypress Bayou, La. and Tex.; Red River, La., South Forked Deer River, Tenn., and Upper Red River from Fulton to head of Raft; of the rivers Big Sun Flower, Coldwater, Yazoo, Yallabusha, and Tallahatchie, and Tchula

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
MAJORS: (continued.)	
	Lake, Miss., and the Mississippi River at Memphis, Natchez, Vidalia, and Vicksburg, and the Big Hatchie River, Tenn.; of removal of raft, snags, and other obstructions from Red River and of closing Tones' Bayou. In charge of 2d District of the Mississippi River from foot of Island No. 40 to mouth of White River, for the purpose of the improvement and construction and repair of levees. In charge of the water-gauges on the Mississippi River and its principal tributaries. In charge of preliminary examination or survey of Red River from its mouth to Fulton; Yallabusha River above Grenada, and Loosacoona River, Miss.; Sulphur River, Tex., from its mouth to Sulphur Station; D'Arbonne River, Bayou Roundaway and Bayou Vidal, La.; Ouachita River from its mouth to Arkadelphia, Ark.; harbors of Monroe and Trenton, La.; Yazoo Pass, including lock to connect the Pass with Mississippi River; Roebuck Lake and Steel's Bayou, Miss., from its mouth to Swan Lake; Black River, from its mouth to Trinity, La.; Red River, La., from Atchafalaya to Fulton, Ark., including relieving the town of Alexandria from encroachments of river, removing snags from Cane River and closing outlet of river known as "Sale and Murphy Canal"; Bayou Pierre, La.; Loggy Bayou, Lake Bisteneau, and the Dorcheat, Cane River, and Petit Anse Bayou, La.; and mouth of Lake Palmyra. Member of Board of Engineer Officers on building and repair of levees on the Mississippi River.
CAPTAINS.	
Milton B. Adams	On duty under the immediate orders of Major Wilson. In charge of the improvement of the harbors at Dunkirk, N.Y., Ashtabula and Conneaut, Ohio, and Erie, Pa.
Wm. R. Livermore	On detached service; Engineer Officer, Department of Texas.
William H. Heuer	In charge of the construction of forts Jefferson and Taylor, Fla. In charge of the improvement of Sabine Pass, Blue Buck Bar, and Neches River, Tex., and Sabine River, La. and Tex. To report upon the depth and width of a channel secured and maintained by Jetties constructed by James B. Eads at the mouth of the Mississippi River. Member of Board of Engineer Officers on further prosecution of work in connection with dredged channel through Galveston Bay. Engineer 7th and 8th Lighthouse Districts.
William S. Stanton	On detached service; on duty at the Military Academy as instructor of Practical Military Engineering, Military Signaling, and Telegraphy, and in command of Company E, Battalion of Engineers. In charge of extension to Cadet Barracks and of reservoirs and supply line, West Point water works. Member of Board of Officers to meet at West Point, N. Y., to determine damage done to Artillery Garden. Member of General Court-Martial to meet at West Point, N. Y., January 24, 1883.
Thomas H. Handbury	In charge of the improvement of the Arkansas River—removal of snags, &c., Arkansas River, between Fort Smith, Ark., and Wichita, Kan., and at Pine Bluff, and of rivers St. Francis, White, L'Anguille, Fourche Le Fève, and Saline, Ark., and Black and Current, Mo. and Ark., To make survey of

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

Rank and Name.	Duties.
CAPTAINS. (continued.)	certain improvements upon reservation at Hot Springs, Ark., and examine present system of water distribution under instructions of the Secretary of the Interior. In charge of preliminary examination or survey of Little, Saline, and White rivers, and Big Bayou Metre, Ark., and continuation of survey of Arkansas River from Fort Gibson to Wichita, Kans. In charge of general supervision of the work for improving Hot Springs Creek at Hot Springs, Ark., under directions of the Secretary of the Interior.
James C. Post	On duty under the immediate orders of Colonel Gillmore. In temporary charge of the construction of forts Wadsworth, Tompkins and its batteries, N. Y., Monroe and Wool, Va., Caswell, N. C., Moultrie, Sumter, and Johnson, and Castle Pinckney, S. C., forts Jackson and Pulaski, Ga., and Clinch and Marion, Fla. In temporary charge of the improvement of the harbors at Charleston, S. C., and Savannah and Brunswick, Ga. In temporary charge of the improvement of Ashley River and Wappoo Cut, S. C., of the bar at the mouth of St. John's River, and of the inside passage between Fernandina and St. John's, Fla., Volusia Bar, Fla., Cumberland Sound, Ga. and Fla., Savannah and Altamaha rivers, St. Augustine Creek, and Romley Marsh, Ga., and Edisto and Salkahatchie rivers, S. C. In temporary charge of removal of wreck of steamer Maple Leaf from channel of St. John's River, Fla. In temporary charge of preliminary examination or survey of channel of St. John's River at its entrance into and exit out of Lake Monroe, and between lakes George and Monroe; and of the north end of Indian River and Mosquito Lagoon, Fla. In charge of the improvement of the Little Kanawha and Guyandotte rivers, W. Va., the Big Sandy River, W. Va. and Ky., and the Kentucky and Tradewater rivers, Ky.
James F. Gregory	On detached service; Aide-de-Camp on the personal staff of the Lieutenant-General of the Army with the rank of Lieutenant-Colonel; Engineer Officer, Military Division of the Missouri.
Henry M. Adams	In charge of the 4th and 5th Divisions, Office of the Chief of Engineers.
James Mercur	In charge of the construction of Fort Macon, N. C. In charge of the improvement of the harbors at Norfolk, Va., Beaufort, N. C., and Georgetown, S. C. In charge of the improvement of the Blackwater, Nottoway, and Archer's Hope rivers, and Pagan Creek, Va., Neuse, Scuppernong, Pamplico, Tar, Yadkin, Trent, Lillington, Cape Fear, Meherin, and New rivers, Currituck Sound, Coanjok Bay, North River Bar, Contentnia and Town creeks, N. C., North Landing River, Va. and N. C., and Waccamaw, Great Pee Dee, Wateree, and Santee rivers, S. C. In charge of preliminary examination or survey of Milford Haven, Va.; the sound between Beaufort and New River, and White Oak River to Smith's Mills; Clubfoot, Harlow, and Newport rivers on line of inland navigation to Beaufort Harbor; Edenton Bay, N. C.; Waccamaw River between Conwayborough, S. C., and Waccamaw Lake; Broad River from Rutherfordton to South Carolina line; Alligator and Black rivers; and sound between Morehead City; Town Creek; Bay River; and Cape Fear

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
CAPTAINS. (continued.)	River above Fayetteville, N. C. Advisory Engineer to National Board of Health in the establishment of a National Quarantine Station in Hampton Roads, Va. Member of Board Advisory to State Harbor Commissioners of Norfolk and Portsmouth, Va.
Chas. E. L. B. Davis	On detached service; Engineer 10th and 11th Lighthouse Districts.
Benjamin D. Green	On duty under the immediate orders of Colonel Gillmore. Resigned to take effect December 31, 1882.
George M. Wheeler	Commissioner to the 3d International Geographical Congress and Exhibition at Venice, and Delegate of the War Department to the latter, now engaged in the preparation of detailed report called for by order of the Secretary of War. In charge of Geographical Surveys of the territory west of the 100th meridian.
James B. Quinn	On duty under the immediate orders of Major Suter. In charge of the improvement of the Yellowstone River; and the Missouri River above the mouth of the Yellowstone; from Sioux City to Fort Benton; and at Vermillion, Dak.
Daniel W. Lockwood	On duty under the immediate orders of Major Stickney. In charge of the improvements of the harbors at Charlevoix, Frankfort, Manistee, Ludington, Pentwater, White River, Muskegon, Grand Haven, Black Lake, Saugatuck, South Haven, St. Joseph, and channel leading up to Benton Harbor, and harbor of refuge at Portage Lake. In charge of the improvement of Grand River from its mouth to City of Grand Rapids. In charge of preliminary examination or survey of harbor at Cross Village and for harbor of refuge at Ludington, Mich.
Ernest H. Ruffner	In local charge of the improvement of the Great Kanawha River under the immediate orders of Lieutenant Colonel Craighill until August 25, 1882. In temporary charge of the improvement of the Great Kanawha and Elk rivers, W. Va., from August 25, 1882, until January 24, 1883. Commanding Company A, Battalion of Engineers.
John C. Mallery	Commanding Company C, Battalion of Engineers. Member of General Court Martial to meet at Willets Point, N. Y., January 3, 1883.
Clinton B. Sears	On detached service; Executive Officer of "The Mississippi River Commission" created by act of Congress, approved June 28, 1879, and Assistant and Secretary to the Committee on Construction. Disbursing officer under the Commission. Detached from duty at the United States Military Academy.
Thomas Turtle	On duty under the immediate orders of Lieutenant Colonel Craighill. Recorder of Boards of Engineer Officers on further improvement of Cape Fear River, N. C., and on improvement of Potomac River near Washington, D. C. In temporary charge of the construction of Defenses of Baltimore, Md., and Washington, D. C. In temporary charge of the improvement of the harbors at Baltimore, Annapolis, Queenstown, and of the inner harbor at Cambridge, Md., and

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
CAPTAINS. (continued.)	Onancock Harbor, Va. In temporary charge of the improvement of the channel of Susquehanna River above and below Havre de Grace, and work at the Fishing Battery light station near Spesutia Island; of the Chester, Wicomico, Pocomoke, Elk, Northeast, and Choptank rivers, Treadhaven, Secretary, and Corsica creeks, and water-passage between Deil's Island and Little Deil's Island, and upper thoroughfare at Deil's Island, Md.; Broad Creek, Del., James and Appomattox rivers, Va., New River, Va. and W. Va., Shenandoah River, W. Va., and Cape Fear River, N. C. In temporary charge of the surveys across the peninsula of Maryland and Delaware to connect by canal the waters of the Delaware and Chesapeake bays. In temporary charge of the building of the monument at Yorktown, Va. In temporary charge of preliminary examination or survey of Pocomoke River, Md.; Monokin River from its mouth to Princess Anne; Wicomico River from its mouth to Salisbury; Pungoteague Creek from Bogg's Wharf to the Warehouse; Hunting and Cherrystone creeks, Va.; Dividing and Wetipkin creeks, Md.; Isle of Wight and Upper Synepuxent Bay, Md., and Indian River, Del., with the intervening land, with view to connecting their waters.
Edward Maguire	On detached service; Engineer Officer, Department of Dakota. In charge of the improvement of the Yellowstone River; and the Missouri River above the mouth of the Yellowstone; from Sioux City to Fort Benton; and at Vermillion, Dak. On eight months' leave of absence from April 15, 1883.
Frederick A. Mahan	On duty under the immediate orders of Lieutenant Colonel Merrill.
Charles F. Powell	In charge of Defenses at the mouth of the Columbia River. In charge of the improvements of the entrance to Coos Bay, and entrance to Yaquina Bay, and mouth of Coquille River, Oreg. In charge of the construction of the Canal around the Cascades of the Columbia River, and of the improvement of the rivers Willamette, and Yamhill, Oreg., Columbia, Oreg. and Wash., and Snake, Cowlitz, Chehalis, Skagit, Stielaquamish, Nootsack, Snohomish, and Snoqualmie rivers, Wash., and Lower Clearwater River, Idaho. In charge of water gauges on the Columbia River from Astoria to the bar. In charge of preliminary examination or survey of the Lewis, Humptulup, and Dwamish rivers, Wash. In charge of the examination or survey of Columbia River at the Dalles. Engineer 13th Lighthouse District. Member of Board of Engineer Officers on improvement of mouth of the Columbia River.
Frederick A. Hinman	On duty under the immediate orders of Lieutenant Colonel Houston. In temporary charge of the improvement of the harbors at Ontonagon, Eagle Harbor, Marquette, Manistique, Cedar River, Mich., Menomonee, Green Bay, Ahnepee, Two Rivers, Manitowoc, Sheboygan, Port Washington, Kewaunee, Pensaukee, and Oconto, Wis.; and harbors of refuge at entrance to Sturgeon Bay Canal, Lake Michigan, and at Grand Marais, Mich. In temporary charge of water level observations on Lake Superior. Temporarily Advisory Engineer for improvement of Kewaunee Harbor, Wis.

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
CAPTAINS. (continued.)	
Albert H. Payson	On duty under the immediate orders of Colonel Stewart. Recorder of the Board of Engineers for the Pacific Coast. Engineer 12th Lighthouse District. Member of Board of Engineer Officers to examine candidates for promotion in the Corps of Engineers.
John G. D. Knight	On detached service; in charge, and disbursing officer, of works on the Mississippi River under supervision of "The Mississippi River Commission" created by act of Congress approved June 28, 1879. In charge of 1st District, of the Mississippi River, from Cairo to foot of Island No. 40, for the purpose of improvement and construction and repair of levees.
Richard L. Hoxie	On duty under the immediate orders of Major Lydecker as his assistant in connection with the Washington Aqueduct and the extension thereof. Assistant to the Engineer Commissioner of the District of Columbia.
William L. Marshall	On detached service; in charge, and disbursing officer, of works on the Mississippi River under supervision of "The Mississippi River Commission" created by act of Congress approved June 28, 1879. In charge of the improvement of the Harbor at Vicksburg, Miss. In charge of 3d District of the Mississippi River, from mouth of White River to Warrenton, for the purpose of improvement and construction and repair of levees. Member of Board of Engineer Officers on building and repair of levees on the Mississippi River.
Joseph H. Willard	Commanding Company B, Battalion of Engineers. Member of General Court Martial to meet at Willets Point, N. Y., January 3, 1883.
Philip M. Price	On duty under the immediate orders of Captain Powell.
Francis V. Greene	On detached service; Assistant to the Engineer Commissioner of the District of Columbia.
Carl F. Palfrey	On duty under the immediate orders of Lieutenant Colonel Mendell.
William H. Bixby	Adjutant and Treasurer of the Battalion of Engineers and Post of Willets Point and Acting Signal Officer, and Recruiting Officer, Post of Willets Point. Commanding Company D, Battalion of Engineers.
FIRST LIEUTENANTS.	
Eric Bergland	On detached service; on duty at the Military Academy as Assistant Professor of Ethics and Law.
Henry S. Taber	On detached service; on duty at the Military Academy as Assistant Instructor of Practical Military Engineering, and with Company E, Battalion of Engineers. Assistant Engineer, West Point water supply. Officer in charge of Post Schools. Member of Railroad Board at West Point. On detached service; Engineer Officer, Department of Dakota. Member of Board of Survey to meet at West Point, August 16, on alleged damaged condition of certain subsistence stores.

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

Rank and Name.	Duties.
FIRST LIEUTENANTS. (continued.)	
William T. Rossell	On duty under the immediate orders of Colonel Gillmore. Temporarily under the immediate orders of Captain Post.
Thomas N. Bailey	On detached service; Engineer Officer, Department of the Missouri. On duty under the immediate orders of Colonel Gillmore. Temporarily under the immediate orders of Captain Post.
Thomas W. Symons	On detached service; Engineer Officer, Department of the Columbia. On official business in Washington, D. C. To inspect and take charge of disposition of property pertaining to Geographical Surveys west of the 100th Meridian. Member of Board of Survey to convene at Vancouver Depot, Wash., on 6th September, 1882. To inspect military bridge recently constructed across the Spokane River near Fort Spokane, Wash. On duty with Mississippi River Commission in connection with the improvement of the Mississippi River below Cairo, Ill. On detached service; on duty under the Department of State in connection with preliminary reconnaissance of boundary line between the United States and Mexico.
Smith S. Leach	On detached service; Secretary and disbursing officer of "The Mississippi River Commission" created by act of Congress approved June 28, 1879.
Dan C. Kingman	On detached service; Engineer Officer Department of the Platte.
Eugene Griffin	Q. M. Battalion of Engineers. A. A. Q. M. and A. C. S., Post of Willets Point.
Willard Young	On detached service; on duty at the Military Academy as Assistant Professor of Civil and Military Engineering. Member of General Court Martial to meet at West Point, N. Y., December 18, 1882.
William M. Black	On duty under the immediate orders of Major Ludlow. On detached service; on duty at the Military Academy as Assistant Instructor of Practical Military Engineering, and with Company E, Battalion of Engineers. Recruiting Officer of Company E, Battalion of Engineers. Officer in charge of Post Schools. Member of Railroad Board at West Point, N. Y. Member of General Court Martial to meet at West Point, N. Y., December 18, 1882.
Walter L. Fisk	On duty under the immediate orders of Major Mansfield.
Solomon W. Roessler	On detached service; on duty at the Military Academy in Department of Civil and Military Engineering. Member of General Court Martial to meet at West Point, N. Y., December 18, 1882.
George McC. Derby	On duty under the immediate orders of Colonel Newton.
James L. Lusk	On detached service; on duty as Adjutant of the Military Academy; commanding officer of band and field music, and

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
FIRST LIEUTENANTS. (continued.)	recruiting officer. On duty under the immediate orders of Major Damrell. On duty with the Battalion of Engineers.
Frederic V. Abbot	On duty under the immediate orders of Major Ernst.
Thomas L. Casey	On duty under the immediate orders of Major Ludlow and Lieutenant Colonel Weitzel, and Secretary to Commission Advisory to Board of Harbor Commissioners of Philadelphia. On detached service; on duty with the expedition to observe the Transit of Venus.
Theodore A. Bingham	On duty under the immediate orders of Major King.
Curtis McD. Townsend	On duty under the immediate orders of Lieutenant Colonel Craighill.
Gustav J. Fiebeger	On detached service; Engineer Officer, Department of Arizona. Member of Board of Officers to meet at Whipple Barracks, August 16, to consider and decide questions which may arise during approaching contest in rifle practice.
Oberlin M. Carter	On duty with Company C, Battalion of Engineers. On detached service; Engineer Officer, Department of the Missouri.
George W. Goethals	On duty with Company A, Battalion of Engineers. On detached service; Engineer Officer, Department of the Columbia.
John Millis	On duty with and in temporary command of Company B, Battalion of Engineers. Recorder of joint Board of Army and Navy officers upon plans and location of a bridge over Thames River at New London, Conn.
John Biddle	On duty with Company C, Battalion of Engineers. Member of General Court-Martial to meet at Willets Point, N. Y., January 3, 1883.
Harry F. Hodges	On duty with Company B, Battalion of Engineers. Member of General Court Martial to meet at Willets Point, N. Y., January 3, 1883.
James G. Warren	On duty with and in temporary command of Company A, Battalion of Engineers.
Edward Burr	On duty with Company C, Battalion of Engineers. Member of General Court Martial to meet at Willets Point, N. Y., January 3, 1883.
SECOND LIEUTENANTS.	
Oscar T. Crosby	On duty with Company A, Battalion of Engineers.
Lansing H. Beach	On special duty at the Military Academy, West Point. On duty with Company B, Battalion of Engineers. Judge Advocate of General Court Martial to meet at Willets Point, January 3, 1883.

Statement showing rank and duties of officers of Corps of Engineers—Cont'd.

RANK AND NAME.	DUTIES.
SECOND LIEUTENANTS. (continued.)	
Graham D. Fitch	On duty with Company C, Battalion of Engineers.
Eugene J. Spencer	Commanding Troop C, 4th Cavalry. Under orders to report to Commanding Officer, Battalion of Engineers, for duty.
George A. Zinn	On graduating leave of absence.
William C. Langfitt	On graduating leave of absence.
Henry E. Waterman	On graduating leave of absence.
OFFICERS OF THE ARMY DETAILED FOR SERVICE UNDER THE CHIEF OF ENGINEERS.	
A. F. Rockwell *Captain, A. Q. M., Bvt. Lieut. Colonel.*	In charge, under the Chief of Engineers, of Public Buildings and Grounds in the District of Columbia, with the rank of Colonel.
M. M. Macomb *Lieut. 4th U. S. Art'y.*	In charge of Geographical Surveys of the territory west of the 100th meridian.
UNITED STATES CIVIL ENGINEERS.	
S. T. Abert	In charge of the improvement of the harbors at Washington and Georgetown, D. C., harbor at Breton Bay, Leonardtown, and at entrance of St. Jerome Creek, Md. In charge of the improvement of the Rivers Rappahannock, Chickahominy, Mattaponi, Totusky, York, Pamunky, and Staunton Va., Roanoke and French Broad, N. C., and Dan River, Va. and N. C.; of channel in Potomac River through flats in front of landing at Mount Vernon; of Neabsco, Nomini, and Urbana creeks, Va. In charge of the examination or survey of Potomac and Anacostia rivers, in vicinity of Washington, D. C., with reference to improvement of navigation, the establishment of harbor-line and raising of flats, so far as their improvement may be necessary, &c. In charge of preliminary examination or survey of Piscataway, Chicamuxen, and Port Tobacco creeks, Md.; Quantico, Hull's and Piscataway creeks, Great Wicomico from Cedar Point to Indian Point, and Piankatank River, Va., and Roanoke River, N. C.
M. Meigs	On duty under immediate orders of Major Mackenzie.

LAWS

AFFECTING

THE CORPS OF ENGINEERS,

UNITED STATES ARMY,

FORTY-SEVENTH CONGRESS, SECOND SESSION.

1882-'83.

LAWS

AFFECTING

THE CORPS OF ENGINEERS, UNITED STATES ARMY.

FORTY-SEVENTH CONGRESS, SECOND SESSION, 1882–'83.

CHAP. 44.—An act supplementary to an act approved December seventeenth, eighteen hundred and seventy-two, entitled "An act to authorize the construction of bridges across the Ohio River, and to prescribe the dimensions of the same." Feb. 14, 1883.

Bridges across the Ohio River.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act of Congress approved December seventeenth, eighteen hundred and seventy-two, entitled "An act to authorize the construction of bridges across the Ohio River, and to prescribe the dimensions of the same," shall be, and the same is hereby, amended by striking out sections two and four of said act and substituting therefor the following:

Stat., 17, 398. Amended. Constitution.

"SEC. 2. That every bridge hereafter erected across the Ohio River shall have its axis at right angles to the current at all stages, and all of its spans shall be through spans. Every such bridge shall have at least one channel-span placed over that part of the river usually run by descending coal-fleets, said channel-span to give a clear water-way between the piers of five hundred feet, measured on the low-water line. Said channel-span shall be at least forty feet above local highest water, measured to the lowest part of the span, and shall be at least ninety feet above low water in bridges built above the mouth of the Big Sandy River, and at least one hundred feet above low water in bridges built below the mouth of the Big Sandy River, measured to the lowest part of the span: *Provided, however*, That all bridges over the Ohio River below the Covington and Cincinnati suspension bridge shall have, in addition to the channel-span prescribed above, a pivot-draw giving two clear openings of one hundred and sixty feet each, measured at right angles to the current at high stages, and located in a part of the bridge that can be safely and conveniently reached at such stages; that said draw shall be provided with suitable rest-piers above and below the pivot-pier, and suitable floats or crib-work connecting said rest-piers with the pivot-pier, to enable boats to pass through said draw with safety; that in case said draw span is near either shore, the bridge company, by purchase or otherwise, shall extinguish the right of mooring boats or other water craft to the adjacent shore for a distance of at least seven hundred feet above and seven hundred feet below the bridge; and that said draw shall be opened promptly, upon reasonable signal, for the passage of boats whose construction shall not be such as to admit of their passage under the stationary spans of said bridge, except when trains are passing over the same; but in no case shall unnecessary delay occur in opening said draw before or after the passage of a train: *Provided, further*, That in lieu of the high draw prescribed above, bridges over the Ohio River below the Covington and Cincinnati suspension bridge may be built as continuous bridges, with a clear height of fifty-three feet above local highest water, measured to the lowest part of the channel span."

Provisos.

Plan and location to be approved by Secretary of War.

"SEC. 4. That any person, company, or corporation authorized to construct a bridge across the Ohio River shall give notice, by publication for one week in newspapers having a wide circulation, in not less than two newspapers in the cities of Pittsburgh, Cincinnati, and Louisville for bridges above the mouth of the Big Sandy, and in the cities of Pittsburgh, Cincinnati, Louisville, Saint Louis, Memphis, and New Orleans for bridges

below the mouth of the Big Sandy, and shall submit to the Secretary of War, for his examination, a design and drawings of the bridge and piers, and a map of the location, giving, for the space of at least one mile above and one mile below the proposed location, the topography of the banks of the river and the shore lines at high and low water. This map shall be accompanied by others, drawn on the scale of one inch to two hundred feet, giving, for a space of one half a mile above the line of the proposed bridge and a quarter of a mile below, an accurate representation of the bottom of the river, by contour lines two feet apart, determined by accurate soundings, and also showing over the whole width of this part of the river the force and direction of the currents at low water, at high water, and at least one intermediate stage, by triangulated observations on suitable floats. The maps shall also show the locations of other bridges in the vicinity, and shall give such other information as the Secretary of War may require for a full and satisfactory understanding of the subject. Said maps and drawings shall be referred to a board of engineers for examination and report, which board shall personally examine the site of the proposed bridge, and shall hold a public session at some convenient point to hear all objections thereto, of which public session due notice and invitation to be present shall be given to all interested parties; and if said board of engineers reports that the site is unfavorable, the Secretary of War shall be authorized, on the recommendation of said board, to order such changes in the bridge or its piers or such guiding-dikes or other auxiliary works as may be necessary, at the expense of the proprietors or managers of such bridge or piers and other works for the security of navigation; and the proposed bridge shall only be a legal structure when built as approved by the Secretary of War."

SEC. 5. That the right to alter, amend or repeal this act as set forth in section seven of the act hereby amended is hereby reserved.

Approved, February fourteenth, 1833.

Feb. 22, 1883.

CHAP. 52. An act to authorize the construction of certain bridges, and to establish them as post-roads.

Bridge across Lake Champlain.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be lawful for the Lamoille Valley Extension Railroad Company, and the Ogdensburgh and Lake Champlain Railroad Company, and their respective successors and assigns, to construct a bridge across Lake Champlain from Alburgh, Vermont, to Rouse's Point, New York, for the purpose of connecting the railroads of said companies, and to maintain and use the said bridge for the transportation of the mails, and for the benefit of commerce and the transportation of persons and property. The said bridge shall be built on the north side of the existing bridge connecting the said Ogdensburgh and Lake Champlain Railroad with the Vermont and Canada Railroad, but not to interfere with or in any way injure said existing bridge or its use. The bridge authorized by this act shall be constructed and maintained with two suitable draws, one of which shall be at least sixty feet wide, and the other at least ninety feet wide, which shall be opposite to and made to correspond with the draws in the existing bridge, so as to afford the best passage of vessels through the draws of both said bridges.

Bridge across Missisquoy Bay.

SEC. 2. That it shall be lawful for the Lamoille Valley Extension Railroad Company, their successors and assigns, to construct, maintain, and use, for the passage of cars, a bridge across Missisquoy Bay, from the town of Swanton to the town of Alburgh, Vermont. The said bridge may be constructed either north or south of the existing bridge across said bay of the Vermont and Canada Railroad Company, but shall be so constructed as not to injure or in any way interfere with the use and operation of said existing bridge. The bridge authorized by this section shall be constructed with a suitable draw for the passage of vessels, as wide as the draw in the existing bridge, and so located as to give vessels the best facilities for passing the draws of both said bridges.

Draw.

Free navigation preserved.

SEC. 3. That the said bridges shall not interfere with the free navigation of said lake and bay, respectively, beyond what is necessary in order to carry into effect the rights and privileges hereby granted; and in case

of any litigation arising from any obstruction or alleged obstruction to the free navigation of said lake or bay, the cause may be tried before the district court of the United States of any State in which any portion of said obstruction or bridge touches; and that the draws of the said bridges shall be opened promptly upon reasonable signal for the passage of boats.

Signals.

SEC. 4. That any bridge constructed under this act and according to its limitations shall be a lawful structure, and shall be known and recognized as a post-route, and the same is hereby declared to be a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States, or for passengers or freight passing over said bridge, than the rate per mile paid for their transportation over the railroads and public highways leading to the said bridge; and the United States shall have the right of way for a postal telegraph across said bridge.

Declared a lawful structure and post-route.

Right of way for postal telegraph.

SEC. 5. That all railway companies desiring to use said bridge shall have and be entitled to equal rights and privileges in the passage of the same, and in the use of the machinery and fixtures thereof, and of all the approaches thereto, under and upon such terms and conditions as shall be prescribed by the Secretary of War, upon hearing the allegations and proofs of the parties, in case they shall not agree.

SEC. 6. That the structures herein authorized shall be built and located under and subject to such regulations for the security of navigation of said lake or bay as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of said bridge, and a map of the location, giving for the space of one mile above and one mile below the proposed location the topography of the banks of the lake or bay, the shore-lines at high and low water, the direction and strength of the current, and the soundings, accurately showing the bed of the lake or bay, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built; and should any change be made in the plan of said bridge during the process of construction such change shall be subject to the approval of the Secretary of War. And the said structure shall be at all times so kept and managed as to offer reasonable and proper means for the passage of vessels through or under said structure; and to secure the safe passage of vessels at night there shall be displayed on said bridge, from the hour of sunset to that of sunrise, such lights as may be prescribed by the Secretary of War; and the said structure shall be changed, at the cost and expense of the owners thereof, from time to time, as Congress may direct, so as not to prevent the free and convenient navigation of said lake or bay; and the authority to erect and continue said bridge shall be subject to revocation and modification by law, whenever the public good shall in the judgment of Congress so require, without any expense or charge to the United States.

Plans, etc., to be submitted to and approved by the Secretary of War.

Lights, etc.

SEC. 7. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Repeal.

SEC. 8. That this act shall take effect and be in force from and after its passage.

Approved, February 22, 1883.

CHAP. 93.—An act making appropriations for the support of the Army for the fiscal year ending June thirtieth, eighteen hundred and eighty-four, and for other purposes.

Mar. 3, 1883.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, for the support of the Army for the year ending June thirtieth, eighteen hundred and eighty-four, as follows:

Appropriations. Army.

* * * * * * *

ENGINEER DEPARTMENT.—For engineer depot at Willet's Point, New York, namely: For purchase of engineering materials to continue the present course of instruction of the Engineer Battalion in their special duties of sappers, miners, and pontoniers, one thousand dollars.

Engineer Depot. Willet's Point.

For incidental expenses of the depot, remodeling ponton-trains, repairing instruments, purchasing fuel, forage, stationery, chemicals, extra-

duty pay to enlisted men employed as artisans, and ordinary repairs, three thousand dollars.

For replacing with plain structures, of cost not to exceed eight thousand dollars, two old buildings constructed during the war for hospitals, and now used as photograph laboratory for instructing enlisted men in duplicating military maps in the field, and as molding-room for instruction in field fortifications, three thousand dollars.

* * * * * * *

Approved, March 3, 1883.

Mar. 3, 1883.

CHAP. 94.—An act "to authorize the construction of a bridge across the Thames River, near New London in the State of Connecticut, and declare it a post-route."

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the bridge across the Thames River, not below Winthrop's Point, and also across any inlet thereof, in the State of Connecticut, to be constructed under and by virtue of joint resolution of the legislature of the State of Connecticut entitled "A resolution authorizing the New York, Providence and Boston Railroad Company to bridge the Thames River, and to extend its lines," passed at its January session, eighteen hundred and eighty-two, is hereby declared to be, when completed in accordance with the aforesaid joint resolution of the legislature of the State of Connecticut, a lawful structure and a post-route for the conveyance of the mails of the United States: *Provided*, That no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States, or for passengers and freight passing over said bridge, than the rate per mile paid for the transportation over the railroads leading to the said bridge; and it shall enjoy the rights and privileges of other post-roads in the United States: *And provided further*, That the said bridge shall be built with a pivot-draw, not less than five hundred feet in length, and so as to not practically interfere with the navigation of said river for commercial or naval purposes, or the usefulness and efficiency of the navy-yard upon the same. In order to secure a compliance with these conditions, the said New York, Providence and Boston Railroad Company, previous to commencing the construction of said bridge, shall submit to the Secretary of War and the Secretary of the Navy of the United States a plan of said bridge, and of the location thereof, with a detailed map of the river at the proposed site of said bridge, and for the distance of a mile above and below such site, exhibiting such information touching said bridge and river as may be deemed requisite by said Secretary of War and said Secretary of the Navy to determine whether the said bridge, when built, will conform to the prescribed conditions of this act, to not practically interfere with the navigation of said river for commercial and naval purposes, or the usefulness and efficiency of the navy-yard upon the same.

Construction of bridge across Thames River, Conn.

Declared a lawful structure and post-route.

Proviso.

Proviso. Pivot-draw.

Plan of bridge and location submitted to Secretary of War and Navy, for approval.

SEC. 2. That the Secretary of War and the Secretary of the Navy are hereby authorized and directed, upon receiving said plan and map and other information, and on the application of said railroad company, to designate a board of competent Army and Navy officers to examine such plan and location, and if, in the opinion of said board, such plan and location, or any modification thereof, will not practically interfere with the navigation of said river for commercial or naval purposes, or the usefulness and efficiency of the navy-yard upon the same, said board is hereby authorized to approve the same. The approval of said board shall be filed with the Secretary of War, and upon the filing thereof it shall be the duty of the Secretary of War, in writing, to notify said railroad company thereof; and, upon receiving such notification, the said company may proceed to the erection of said bridge, conforming strictly to such approved plan and location. Until the said board, so appointed as aforesaid, shall approve the plan and location of said bridge, and the Secretary of War shall, in writing, notify said railroad company of the same, said bridge shall not be built or commenced. And the said bridge shall be at all times so kept and managed as to offer reasonable and proper means for the passage of vessels through said structure; and to secure the safe passage of vessels at night there shall be displayed on said bridge, from the hour of sunset to that of sunrise, such lights as may be prescribed by the Secretary of War.

Board to examine and report on plans, etc.

Approval of Board.

Lights and signals.

SEC. 3. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any one of them, desiring such use, shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War, upon a hearing of the allegations and proofs of the parties: *Provided*, That the provisions of section one in regard to charges for passengers and freight across said bridge, shall not govern the Secretary of War in determining any question arising as to the sum or sums to be paid to the owners of said bridge by said companies for the use of said bridge.

Equal rights and privileges to other railroads.

Compensation.

Proviso.

SEC. 4. That the right to alter, amend, or repeal this act is hereby expressly reserved. And the right to require any changes in said structure, or its entire removal, at the expense of the owners thereof, whenever Congress shall decide that the public interest requires it, is also expressly reserved.

Right of repeal, etc., reserved.

Approved, March 3, 1883.

CHAP. 95.—An act making appropriations to provide for the expenses of the Government of the District of Columbia for the fiscal year ending June thirtieth, eighteen hundred and eighty-four, and for other purposes.

Mar. 3, 1883.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the half of the following sums named, respectively, is hereby appropriated, out of any money in the Treasury not otherwise appropriated, and the other half out of the revenues of the District of Columbia, for the purposes following, being the estimated expenses of the government of the District of Columbia for the fiscal year ending June thirtieth, eighteen hundred and eighty-four, namely:

District of Columbia.

Appropriations.

* * * * * * *

For executive office: For two Commissioners, at five thousand dollars each; one Engineer Commissioner, one thousand one hundred and sixty one dollars and fifty cents (to make salary five thousand dollars);

Commissioners.

* * * * * * *

For ordinary care of Benning's, Anacostia, and Chain Bridges, two thousand dollars; and for repairing and maintaining bridges under the control of the Commissioners of the District of Columbia, one thousand five hundred dollars; in all, three thousand five hundred dollars;

Benning's, Anacostia, and Chain Bridges.

WASHINGTON AQUEDUCT.

For engineering, maintenance, and general repairs twenty thousand dollars; and the lessees of the Alexandria Canal shall keep in good repair at least two spans of the aqueduct bridge, so that no leakage or wastage of water shall occur.

Washington Aqueduct.

* * * * * * *

Approved, March 3, 1883.

CHAP. 96.—An act making appropriations for fortifications and other works of defense, and for the armament thereof, for the fiscal year ending June thirtieth, eighteen hundred and eighty-four, and for other purposes.

Mar. 3, 1883.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the sum of one hundred and seventy-five thousand dollars be, and the same is hereby, appropriated, out of any money in the Treasury not otherwise appropriated, for the protection, preservation, and repair of fortifications and other works of defense for the fiscal year ending June thirtieth, eighteen hundred and eighty-four, the same to be expended under the direction of the Secretary of War; also the following for the armament of fortifications, namely:

Appropriations.

Forts and fortifications.

For the armament of sea-coast fortifications, including heavy guns and howitzers for flank defense, carriages, projectiles, fuses, powder, and implements, their trial and proof, and all necessary expenses incident thereto, including compensation of draughtsmen on gun-construction while employed in Ordnance Bureau, and for conversion of ten-inch smooth-bore cannon into rifled guns, making and testing two twelve-inch cast-iron

Armament, etc.

rifled breech-loading cannon, in lieu of such of the guns, the construction of which has not been commenced, as were provided for by the "act making appropriations for fortifications and other works of defense, and for the armament thereof, for the fiscal year ending June thirtieth, eighteen
21 Stat., 109. hundred and eighty-one, and for other purposes," approved May fourth, eighteen hundred and eighty, making and testing two breech-loading steel guns, one eight-inch and one ten-inch, making mortars and gun-carriages, mounting fifteen-inch guns, making and testing two guns banded or wrapped with wire, testing devices for breech-loading guns, testing projectiles, and so forth, in accordance with the report of the Select Committee of the Senate on the Subject of Heavy Ordnance and Projectiles four hundred thousand dollars.

Purchase of machine guns. For the purchase of machine guns of the latest improvement, twenty thousand dollars.

Torpedoes, etc. For torpedoes for harbor defenses, and the preservation of the same, and for torpedo experiments in their application to harbor and land defense, and for instruction of Engineer Battalion in their preparation and
Proviso. application, seventy-five thousand dollars: *Provided*, That one-half of this sum may be used in the purchase of torpedoes of the latest improvement.

Approved, March 3, 1883.

Mar. 3, 1883. CHAP. 100.—An act to authorize the construction of a bridge across the Missouri River at some accessible point within ten miles below and five miles above the city of Kansas City, Missouri.

Be it enacted by the Senate and House of Representatives of the United States

Bridge across the Missouri River; Chillicothe and Kansas City Railway Company authorized to construct. *of America in Congress assembled*, That the Chillicothe and Kansas City Railway Company, a corporation organized under the laws of the State of Missouri, be, and is hereby, authorized to construct and maintain a bridge and approaches thereto over the Missouri River, at some accessible point consistent with the interests of the river navigation within five miles above and ten miles below the present railroad bridge across said river, at the city of Kansas City, in the county of Jackson and State of Missouri. Said bridge shall be constructed to provide for the passage of railway trains, and, at the option of the corporation by which it may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot-passengers, for such reasonable rates of toll as may be approved from time to time by the Secretary of War.

Declared a lawful structure, and a post-route. SEC. 2. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States, or for passengers and freight passing over said bridge than the rate per mile paid for the transportation over the railroad or public highways leading to the said bridge; and it shall enjoy the rights and privileges of other post-roads in the United States.

Spans. SEC. 3. That if said bridge shall be made with unbroken and continuous spans, the spans thereof shall not be less than three hundred feet in length in the clear, and the main span shall be over the main channel of the river. The lowest part of the superstructure of said bridge shall be at least fifty feet above extreme high-water mark, as understood at the point of location, and at least eighty feet above low-water, and the bridge shall be at right angles to, and its piers parallel with, the current of the
Proviso. river: *Provided*, That if the same shall be constructed as a draw-bridge
Construction as draw-bridge. it shall have two or more pivot or draw span openings over the main channel of the river, giving two hundred feet clear channel-way in each opening, and the piers of said bridge shall be parallel with, and the bridge itself at right angles to, the current of the river. Also that all fixed spans located between the shore lines, at the medium stage of water, shall be three hundred feet or more in length, and that the clear head-room under such spans shall not be less than ten feet at highest water;
Proviso. *Provided also*, That said draw shall be opened promptly by said company,
Signals. upon reasonable signal, for the passage of boats; and said company or corporation shall maintain, at its own expense, from sunset till sunrise, such lights or other signals on said bridge as the Light-House Board shall
Not to obstruct free navigation. prescribe. No bridge shall be erected or maintained under the authority of this act which shall at any time substantially or materially obstruct

the free navigation of said river, and if any bridge erected under such authority shall, in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of said bridge to be made as will effectually obviate such obstruction; and all such alterations shall be made and all such obstructions be removed at the expense of the owner or owners of said bridge. And in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river, caused or alleged to be caused by said bridge, the case may be brought in the district court of the United States of the State of Missouri in which any portion of said obstruction or bridge may be located: *Provided further*, That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in reference to the protection of the navigation of rivers, or to exempt this bridge from the operation of the same.

Proviso.

Equal rights and privileges to other railroads.

SEC. 4. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any one of them, desiring such use shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War, upon a hearing of the allegations and proofs of the parties: *Provided*, That the provisions of section two in regard to charges for passengers and freight across said bridge shall not govern the Secretary of War in determining any question arising as to the sum or sums to be paid to the owners of said bridge by said companies for the use of said bridge.

Proviso.

Plans, drawings, location, etc., to be approved by Secretary of War.

SEC. 5. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge, and a map of the location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the currents at all stages, and the soundings accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built; and should any change be made in the plan of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War.

Right to repeal, etc., reserved.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved. And the right to require any changes in said structure or its entire removal, at the expense of the owners thereof, whenever Congress shall decide that the public interest requires it, is also expressly reserved.

Approved, March 3, 1883.

CHAP. 120.—An act to amend chapter fifty-eight of volume twenty of the United States Statutes at Large, relating to contracts under the War Department.

Mar. 3, 1883.

Contracts under War Department.
20 Stat., 36.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That chapter fifty-eight of volume twenty of the United States Statutes at Large, entitled "An act to authorize the Secretary of War to prescribe rules and regulations to be observed in the preparation, submission, and opening of bids for contracts under the War Department," be amended by striking therefrom everything following the words "War Department," and substituting for the part of the act so stricken out the following words:

"And he may require every bid to be accompanied by a written guarantee, signed by one or more responsible persons, to the effect that he or they undertake that the bidder, if his bid is accepted, will, at such time as may be prescribed by the Secretary of War or the officer authorized to make a contract in the premises, give bond, with good and sufficient sure-

Bids, etc.

Bond.

Failure to fulfill contract, etc.

ties, to furnish the supplies proposed or to perform the service required. If after the acceptance of a bid and a notification thereof to the bidder he fails within the time prescribed by the Secretary of War or other duly authorized officer to enter into a contract and furnish a bond with good and sufficient security for the proper fulfillment of its terms, the Secretary or other authorized officer shall proceed to contract with some other person to furnish the supplies or perform the service required, and shall forthwith cause the difference between the amount specified by the bidder in default in the proposal and the amount for which he may have contracted with another party to furnish the supplies or perform the service for the whole period of the proposal to be charged up against the bidder and his guarantor or guarantors, and the sum may be immediately recovered by the United States for the use of the War Department in an action of debt against either or all of such persons."

Approved, March 3, 1883.

Mar. 3, 1883.

CHAP. 128.—An act making appropriations for the legislative, executive, and judicial expenses of the government for the fiscal year ending June thirtieth, eighteen hundred and eighty-four and for other purposes.

Appropriations.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, in full compensation for the service of the fiscal year ending June thirtieth, eighteen hundred and eighty-four, for the objects hereinafter expressed, namely:

* * * * * * *

Office of Chief of Engineers.

IN THE OFFICE OF THE CHIEF OF ENGINEERS.

* * * * * * *

Skilled draughtsmen, civil engineers, and others, authorized.

And the services of skilled draughtsmen, civil engineers, and such other services as the Secretary of War may deem necessary may be employed in the Office of the Chief of Engineers, to carry into effect the various appropriations for rivers and harbors, fortifications, and surveys of military defenses, to be paid for from such appropriations: *Provided*, That the expenditures on this account for the fiscal year ending June thirtieth, eighteen hundred and eighty-four, shall not exceed seventy-five thousand dollars; and that the Secretary of War shall, each year in the annual estimates, report to Congress the number of persons so employed, and the amount paid to each.

Proviso.

* * * * * * *

Rent of buildings.

For rent of buildings for use of the War Department as follows: * * * ; for the Chief of Engineer's office, one thousand six hundred dollars; * * *

Office public buildings and grounds.

PUBLIC BUILDINGS AND GROUNDS.

Clerk and messenger.

For clerk in the Office of Public Buildings and Grounds, one thousand four hundred dollars; and for messenger in the same office, eight hundred and forty dollars.

Public gardener.

For the public gardener, one thousand six hundred dollars.

Foreman, laborers.

For foremen and laborers employed in the public grounds, twenty-six thousand dollars.

Navy-Yard and Upper Bridges draw-keepers.

For two draw-keepers for Navy-Yard and Upper Bridges, one thousand four hundred and forty dollars.

Watchmen.

For watchman in Franklin Square, six hundred and sixty dollars.

For watchman in Lafayette Square, six hundred and sixty dollars.

For two day-watchmen in Smithsonian Grounds, at six hundred and sixty dollars each, one thousand three hundred and twenty dollars.

For two night watchmen in Smithsonian Grounds, at seven hundred and twenty dollars each, one thousand four hundred and forty dollars.

For one watchman for Judiciary Square, and one for Lincoln Square and adjacent reservations, at six hundred and sixty dollars each, one thousand three hundred and twenty dollars.

For one watchman for Iowa Circle, one watchman for Fourteenth-street Circle and neighboring reservations, one for Rawlins Square and

Washington Circle, one watchman for McPherson and Farragut Squares, one for Stanton Place and neighboring reservations, one for Armory Square and reservations east to Botanical Garden, one for Mount Vernon Square and adjacent reservations, seven in all, at six hundred and sixty dollars each, four thousand six hundred and twenty dollars.

For one bridge-keeper at Chain Bridge, six hundred and sixty dollars. Bridge-keeper at Chain Bridge,

For contingent and incidental expenses, five hundred dollars. Contingent expenses.

For rent of office, nine hundred dollars.

* * * * * * *

Approved, March 3, 1883.

CHAP. 136.—An act to authorize the construction of bridges over the Ogeechee, Oconee, Ocomulgee, Flint and Chattahoochee Rivers, in the State of Georgia

Mar. 3, 1883.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Savannah and Pacific Short Line Railway Company be, and it is hereby, authorized to construct bridges over the Ogeechee River, in the county of Chatham; over the Oconee, in the county of Montgomery; over the Ocmulgee, in the county of Pulaski; over the Flint River, in the county of Dooly, and over the Chattahoochee River, in Stewart or Muscogee Counties, or such other county as said railroad company may desire or find most practicable in the final location of said road. Savannah and Pacific Short Line Railway Company authorized to construct bridges over Ogeechee, Oconee, Ocmulgee, Flint, and Chattahoochee Rivers, in State of Georgia.

SEC. 2—That said bridges shall be so constructed, either by draw, span, or otherwise, so that a free and unobstructed passage may be secured to all vessels and other water-craft navigating said rivers. Free navigation.

SEC. 3—That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States, or passengers or freight passing over said bridges, than the rate per mile paid for the transportation over the railroad or public highways leading to the said bridges; and it shall enjoy the rights and privileges of other post-roads in the United States. Declared a lawful structure and post-route.

SEC. 4—That if any of the said bridges authorized to be constructed by this act shall be constructed as a draw-bridge, the draw shall be opened promptly upon reasonable signals for the passage of boats; and said company or corporation shall maintain, at its own expense, from sunset till sunrise, such lights or other signals on said bridge or bridges as the Light-House Board shall prescribe. No bridge shall be erected or maintained under the authority of this act which shall at any time substantially or materially obstruct the free navigation of said river, and if any bridge erected under such authority shall in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of said bridge to be made as will effectually obviate such obstruction; and all such obstructions shall be removed and alterations made at the expense of the owner or owners of said bridge: *Provided*, That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in reference to the protection of the navigation of rivers, or to exempt this bridge erected under this act, from the operations of the same. Signals. *Proviso.*

SEC. 5—That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same, and over the approaches thereto, upon the payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any one of them, desiring such use, shall fail to agree upon the sum or sums, to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War, upon a hearing of the allegations and proofs of the parties. Equal rights and privileges to other railroads.

SEC. 6—That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said rivers as the Secretary of War shall prescribe; and to secure that object said company or corporation shall submit to the Secretary of War a design and drawings of said bridges to be Designs, drawings, maps, etc., to be submitted to Secretary of War for approval.

erected, for his examination and approval, and a map of its location, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject, and in all things shall be subject to such rules and regulations as may be prescribed by the Secretary of War; and until said plan and location of said bridge or bridges are approved by the Secretary of War, said bridge or bridges shall not be built; and should any change be made in the plan of any bridge authorized to be constructed by this act, during the progress of the work of construction, such change shall be subject to the approval of the Secretary of War.

Repeal.

SEC. 7—That the right to alter, amend, or repeal this act is hereby expressly reserved; and the right to require any changes in said structures, or their entire removal, at the expense of the owners thereof, whenever Congress shall decide that the public interest requires it is also expressly reserved.

Approved, March 3, 1883.

Mar. 3, 1883.

CHAP. 138.—An act to establish a railway bridge across the Illinois River, extending from a point within five miles of Columbiana in Greene County, to a point within five miles of Farrowtown, in Calhoun County, in the State of Illinois.

Litchfield, Carrollton and Western Railroad Company authorized to construct bridge across Illinois River, etc.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Litchfield, Carrollton and Western Railroad Company, its successors and assigns, are hereby authorized and empowered to erect, establish, and maintain a railway bridge across the Illinois River, extending from a point, to be by them selected, within five miles of Columbiana, in Greene County, to a point, to be selected by them, within five miles of Farrowtown, in Calhoun County, in the State of Illinois; and that said bridge shall not interfere with the free navigation of said river beyond what is necessary in order to carry into effect the rights and privileges hereby granted; and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river, the cause may be tried before the district court of the United States for the southern district of the State of Illinois.

Free navigation.

Draw-bridge, etc.

SEC. 2. That any bridge built under the provisions of this act may, at the option of the company building the same, be built as a draw bridge, with a pivot or other form of draw, or with unbroken or continuous spans;

Proviso.

Provided, That if the said bridge shall be built with unbroken or continuous spans, it shall not be of less elevation in any case than fifty feet above extreme high water mark, as understood at the point of location, to the bottom chord of the bridge, nor shall the spans of said bridge be less than two hundred and fifty feet in length; and the piers of said bridge shall be parallel with the current of said river, and the main span shall be over the main channel of the river, and not less than three hundred feet in length: *And provided also*, That if any bridge built under this act shall be constructed as a draw bridge, the same shall be constructed as a pivot draw bridge, with a draw over the main channel of the river at an accessible and navigable point, and with spans of not less than one hundred and sixty feet in length in the clear on each side of the central or pivot pier of the draw; and the next adjoining spans to the draw shall not be less than two hundred and fifty feet, and said spans shall not be less than thirty feet above low water mark and not less than ten feet above extreme high water mark, measuring to the bottom chord of the bridge; and the piers of said bridge shall be parallel with the current of the river where said bridge may be erected: *And provided also*, That said draw shall be opened promptly, upon reasonable signal, for the passage of boats.

Proviso.

Pivot draw-bridge.

Proviso.

Signals.

Declared a lawful structure and post-route.

SEC. 3. That any bridge constructed under this act and according to its limitations shall be a lawful structure, and shall be known and recognized as a post-route, and the same is hereby declared to be a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States, or for passenger or freight passing over said bridge, than the rate per mile paid for their transportation over the railroads and public highways leading to the said bridge, and the United States shall have the right of way for a postal telegraph across said bridge.

Right of way for postal telegraph.

SEC. 4. That all railway companies desiring to use said bridge shall have and be entitled to equal rights and privileges in the passage of the same, and in the use of the machinery and fixtures thereof, and of all the approaches thereto, under and upon such terms and conditions as shall be prescribed by the Secretary of War, upon hearing the allegations and proofs of the parties, in case they shall not agree.

Equal rights and privileges to other railroads.

SEC. 5. That the structure herein authorized shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination or approval, a design and drawings of said bridge, and a map of the location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore lines at high and low water, the direction and strength of the current at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built; and should any change be made in the plan of said bridge during the process of construction, such change shall be subject to the approval of the Secretary of War. And the said structure shall be at all times so managed and kept as to offer reasonable and proper means for the passage of vessels through or under said structure; and to secure the safe passage of vessels at night there shall be displayed on said bridge, from the hour of sunset to that of sunrise, such lights as may be prescribed by the Secretary of War; and the said structure shall be changed, at the cost and expense of the owners thereof, from time to time, as Congress may direct, so as to preserve the free and convenient navigation of said river; and the authority to erect and continue said bridge shall be subject to revocation and and modification by law, whenever the public good shall in the judgment of Congress so require, without any expense or charge to the United States.

Security of navigation, etc.

Design, drawings, and map of location to be submitted to Secretary of War for approval.

Lights, etc.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Rights reserved.

SEC. 7. That this act shall take effect and be in force from and after its passage.

Approved, March 3, 1883.

CHAP. 141.—An act making appropriations to supply deficiencies in the appropriations for the fiscal year ending June thirtieth, eighteen hundred and eighty-three, and for prior years, and for those certified as due by the accounting officers of the Treasury in accordance with section four of the act of June fourteenth, eighteen hundred and seventy-eight, heretofore paid from permanent appropriations, and for other purposes.

Mar. 3, 1883.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, for the objects hereinafter stated, namely:

To supply deficiencies in the appropriations for the fiscal year eighteen hundred and eighty-three, as follows:

Deficiency appropriations, 1883, for prior years, and under section four, act June 14, 1878.

* * * * * * *

MISCELLANEOUS.

Miscellaneous.

* * * * * * *

To enable the Secretary of War to pay to J. C. Burdick eight hundred and twenty dollars, to E. M. Wadsworth eight hundred and twenty dollars, and to C. A. Peck eight hundred and twenty dollars, commissioners appointed under the authority of an act of Congress approved March third, eighteen hundred and seventy-five, entitled "An act to aid in the improvement of the Fox and Wisconsin Rivers, in the State of Wisconsin," for services in ascertaining and awarding the amount of damages by reason of the flowage of lands caused by the improvement of the Fox and Wisconsin Rivers, in the State of Wisconsin.

J. C. Burdick, E. M. Wadsworth, C. A. Peck, payment to.
18 Stat., 506.

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Contingencies, fortifications. For contingencies of fortifications, one hundred and fifty-eight dollars and fifty-one cents.

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Approved, March 3, 1883.

Mar. 3, 1883. CHAP. 143.—An act making appropriations for sundry civil expenses of the government for the fiscal year ending June thirtieth, eighteen hundred and eighty-four, and for other purposes.

Appropriations. Sundry civil expenses. *Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That the following sums be, and the same are hereby, appropriated for the objects hereinafter expressed for the fiscal year ending June thirtieth, eighteen hundred and eighty-four, namely:

* * * * * * *

Public buildings and grounds in Washington.

BUILDINGS AND GROUNDS IN AND AROUND WASHINGTON.

For the improvement and care of public grounds, as follows:

For improving grounds south of the Executive Mansion, fifteen thousand dollars.

For ordinary care of greenhouses and nursery, including construction of one large house for storage and protection of palms and other tropical and subtropical plants, two thousand five hundred dollars.

For improving reservation on South Carolina avenue, between Fourth and Sixth streets east, fifteen hundred dollars.

For improving reservation on North Carolina avenue, between Second and Third streets east, one thousand dollars.

For ordinary care of Lafayette Square, one thousand dollars.

For care and improvement of reservation numbered three (Monument Grounds), one thousand dollars.

For continuing improvement of reservation numbered seventeen, and site of old canal, northwest of same, twenty thousand dollars: *Provided*, That no part thereof shall be expended upon other than property belonging to the United States.

For construction and repair of iron fences, five hundred dollars.

For manure, and hauling the same, five thousand dollars.

For painting iron fences, vases, lamps, and lamp-posts, one thousand five hundred dollars.

For purchase and repair of seats, one thousand dollars.

For purchase and repair of tools, two thousand dollars.

For trees, tree-stakes, lime, whitewashing, and stock for nursery, three thousand dollars.

For removing snow and ice, one thousand dollars.

For flower-pots, twine, baskets, and lycopodium, one thousand dollars.

For care, construction, and repair of fountains in the public grounds, one thousand five hundred dollars.

For abating nuisance, five hundred dollars.

For improving various reservations, fifteen thousand dollars.

For improvement and care of Smithsonian Grounds, five thousand dollars.

Executive Mansion. For repairs and fuel at the Executive Mansion as follows:

For care and repair of the Executive Mansion, and for refurnishing the Executive Mansion, twenty-five thousand dollars.

For fuel for the Executive Mansion and greenhouses, two thousand five hundred dollars.

For care and necessary repair of the conservatories of the Executive Mansion, five thousand five hundred dollars.

For lighting the Executive Mansion and public grounds: For gas, pay of lamp-lighters, gas-fitters, plumbers, plumbing, lamps, lamp-posts, matches, and repairs of all kinds; fuel and lights for office, stables, watchmen's lodges, and for the greenhouses at the nursery, fifteen thousand dollars: *Provided*, That for each six-foot burner not connected with a meter in the lamps on the public grounds no more than twenty-two dollars shall be paid per lamp for gas, including lighting, cleaning, and keeping in repair the lamps, under any expenditure provided for in this act.

Proviso.

Water-pipes, etc. For repair of water-pipes and fire-plugs: For repairing and extending water-pipes, purchase of apparatus to clean them, and cleaning the springs and repairing and renewing the pipes to the same that supply the Capitol,

the Executive Mansion, and the building for the State, War, and Navy Departments, two thousand five hundred dollars; and all officers in charge of public buildings in the District of Columbia shall cause the flow of water in the buildings under their charge to be shut off from five o'clock post meridian to eight o'clock ante meridian: *Provided*, That the water in said public buildings is not necessarily in use for public business.

Proviso.

Telegraph, Capitol, departments, and printing office.

For telegraph to connect the Capitol with the departments and Government Printing Office: For care and repair of the same, one thousand dollars.

State, War, and Navy Department building.

For the building for the State, War, and Navy Departments: For clearing the site, laying foundations, building walls of the lower stories, and continuing the preparation of cut granite for the west and center wings, and for each and every purpose connected with the same, including the rent of necessary office-rooms, five hundred thousand dollars. And so much of the appropriation for furniture, carpets, file-cases, and shelving for the north wing of said building contained in the sundry civil appropriation act approved August seventh, eighteen hundred and eighty-two, as shall remain unexpended June thirtieth, eighteen hundred and eighty-three, is hereby reappropriated for the same purpose.

Pamphlet edition, laws 1 Sess., 47th Cong., 318.

Washington Monument.

For completion of the Washington Monument: For marble, granite, iron frame work, machinery, tools, labor, office expenses, including the rent of necessary office-rooms, and for each and every purpose connected with the completion of the monument, two hundred and fifty thousand dollars.

* * * * * * *

Survey of northern and northwestern lakes.

Survey of northern and northwestern lakes: For printing and issuing charts for use of navigators, electrotyping copper-plates for chart printing and completion of office-work, three thousand dollars.

Transportation of reports and maps to foreign countries.

For the transportation of reports and maps to foreign countries: For the transportation of reports and maps to foreign countries, through the Smithsonian Institution, three hundred dollars.

* * * * * * *

Sea wall, Governor's Island.

For completing the sea wall on the west side and southeastern portion of Governor's Island, New York Harbor, fifteen thousand dollars; the same to be immediately available.

* * * * * * *

Mississippi River Commission.

For the Mississippi River Commission, as follows:

For salaries and traveling expenses, of the commission, office expenses, and reduction of work; for continuation of surveys and gaugings of the Mississippi River and its tributaries for permanent gauge-stations and borings, and for publication of maps and results, one hundred and fifty thousand dollars; and an itemized statement of the expenditure of this sum shall be included with the annual report of the commission to Congress.

* * * * * * *

Yellowstone National Park.

For the protection and improvement of the Yellowstone National Park: For every purpose and object necessary for the protection, preservation, and improvement of the Yellowstone National Park, including compensation of superintendent and employees, forty thousand dollars, two thousand dollars of said amount to be paid annually to a superintendent of said park and not exceeding nine hundred dollars annually to each of ten assistants, all of whom shall be appointed by the Secretary of the Interior, and reside continuously in the park and whose duty it shall be to protect the game, timber, and objects of intrest therein; the balance of the sum appropriated to be expended in the construction and improvement of suitable roads and bridges within said park, under the supervision and direction of an engineer officer detailed by the Secretary of War for that purpose;

* * * * * * *

Approved March 3, 1883.

[No. 25.] Joint resolution concerning the erection of a memorial column at Washington's Headquarters, at Newburg, New York.

Mar. 3, 1883.

Memorial column at Washington's Headquarters, Newburg, N. Y.; act authorizing, etc., amended.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That sections two and three of the joint resolution of Congress approved July first, eighteen hundred and eighty-two, authorizing the Secretary of War to erect at Washington's Headquarters, in the city of Newburg, New York, a memorial column, and to aid in defraying the expenses of the centennial celebration to be held at

Pamphlet edition, laws, 1st sess. 47th Cong., 385.

that city in the year eighteen hundred and eighty-three, be, and the same are hereby, amended so as to read as follows: "That the sum of twenty-five thousand dollars, or so much thereof as may be necessary, be, and the same is hereby, appropriated, out of any money in the Treasury not otherwise appropriated, to be expended under the direction of the Secretary of War, in the erection of a suitable monument or column on the grounds belonging to the State of New York, and known as Washington's Headquarters, with such inscriptions and emblems as may properly commemorate the historical events which occurred at Newburg and vicinity during the war of the Revolution: *Provided*, That the design for said monument or column, with the inscriptions and emblems to be placed thereon, shall be subject to the approval and adoption of the joint select committee directed to be appointed by the joint resolution to which this is an amendment: *And provided further*, That no part of the said sum of twenty-five thousand dollars shall be used in defraying the expenses of said centennial celebration."

Proviso.

Approved, March 3, 1883.

APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

FORTIFICATIONS, ETC.

APPENDIX No. 1.

SEA-WALL AT GOVERNOR'S ISLAND, NEW YORK HARBOR.

REPORT OF MAJOR GEORGE L. GILLESPIE, CORPS OF ENGINEERS, BVT. LIEUT. COL., U. S. A., OFFICER IN CHARGE OF THE WORK, FOR THE FISCAL YEAR ENDING JUNE 30, 1883.

The act approved August 7, 1882, appropriated $39,000 for continuing the sea-wall construction suspended in 1866.

Sealed proposals for the delivery of material and for construction, invited by public advertisement, were opened in this office November 22, 1882, and the contract awarded to Mr. F. H. Smith, the lowest bidder, at $18.72 per linear foot. The lowest bid for filling was 43 cents per cubic yard in place; this was deemed excessive and was not accepted.

Later a supplementary contract, approved by the Department May 15, 1883, was made with the contractor, dated May 12, 1883, for furnishing the material at 29½ cents per cubic yard, and also for extending the south wall to a connection with the east wall at $15 per linear foot, the Government providing the stone.

The wall, when completed, will extend from the coal dock at the main landing to the eastern extremity of the sea-wall at the South Battery. It will be 1,750 feet long and 8 feet high, and will be built of granite blocks, in regular courses, resting upon a pile foundation consolidated by concrete. The unstable character of the subsoil, for a depth of 4 to 6 feet below the surface, made piling necessary. The space between the site of the new wall and the old wooden revetment will be filled with suitable material and graded.

The contractor commenced operations in May, and up to the close of the fiscal year had built a running length of 300 feet, approximately, of the wall. The sewer connections of the post are made as far as the wall has progressed, the piling for the foundation is practically completed, and a part of the earth filling has been put in. By act of Congress approved March 3, 1883, an additional appropriation was made of $15,000

for completing the work projected on the east side. The removal of the large masses of stone lying in front of the wall, the great amount of earth filling required, and the unexpected expense incurred in making a pile foundation were the important considerations which led me to ask for this appropriation.

There is, properly speaking, no sea-wall on the west side except the short circular portion, 400 feet long, which surrounds Castle Williams. The other construction, called a sea-wall, between Castle Williams and the old hospital on the south side, is simply a dry wall, laid near the high-water line, which was hastily built out of surplus stone from the south wall, and was intended to protect the outer slope of a projected battery on that side against sea encroachment. It has answered this temporary purpose very well; but to perfect the plans of sea-wall projected for the improvement of the entire island, the dry wall should be replaced by a wall near the low-water line, connecting the south end of the Castle Williams branch with the west end of the south wall. Such a wall will be 1,500 feet long, and if extended from Castle Williams eastward, to connect with the wall fronting the arsenal grounds, the length will be increased to 2,600 feet.

The island is particularly exposed to the deposit upon its unprotected beach at high tide of offal and other floating matters of an objectionable nature, which have been dumped into the waters which circulate around the island. The north front suffers from deposits of this kind at almost every tide; the nuisance can only be removed by completing the sea-wall from the arsenal front, around by the westward, to the terminus of the south wall.

It is estimated that the sum of $100,000 will be needed to complete the wall and provide 66,000 cubic yards of filling behind it, and an appropriation of that sum is earnestly recommended.

Money statement.

Amount appropriated by act passed August 7, 1882		$39,000 00
Amount appropriated by act passed March 3, 1883		15,000 00
Total available during fiscal year ending June 30, 1883		54,000 00
Amount expended to June 30, 1883, exclusive of outstanding liabilities	$9,122 74	
Outstanding liabilities	843 86	
		9,966 60
Amount available July 1, 1883		44,033 40
Amount (estimated) required for completing sea-wall around the island		100,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		100,000 00

Abstract of proposals for constructing sea-wall at Governor's Island, New York Harbor, opened November 22, 1882, by Maj. G. L. Gillespie, Corps of Engineers, United States Army.

Number.	Names of bidders.	Wall (backing and foundation), complete, per running foot.	Granite, rough hammered, ready for laying, per cubic foot.	Granite, rough, per cubic foot.	Rough hammering granite, per superficial foot.	Material filling behind the wall (in place) per cubic yard.	Remarks.
1	John Satterlee	$22 94	.....	$0 37	$0 17	.....	
2	John A. Bouker	.....	.....	.....	.....	$0 43	Measured on scows.
3	James M. & W. Andrews	24 50	.....	40	20	.....	
4	Francis H. Smith	18 72	$0 55	.....	.....	45	Lowest bid for building sea-wall.
5	The Morgan's Bay Granite Company.	.....	.....	40	20	.....	
6	Samuel R. Cumming	25 49	69	.....	.....	49	
7	John Beattie	*21 50	.....	44	16½	.....	
8	Thomas McCann	29 75	82	45	.....	†30 65	
9	Joseph Wescott & Son	.....	95	.....	.....	.....	
10	Frederick K. Ballou	28 34	60	34	16⅔	.....	
11	The Smith Granite Company	.....	84	.....	.....	.....	
12	Ellsworth & Blue Hill Granite Company.	.....	.....	41	‡10¼	.....	
13	Mount Waldo Granite Company.	.....	14 97 §15 62	.....	.....	.....	

*Back filling excepted.
†On the scows and in place, respectively.
‡Not including dowel holes.
§Per running foot, without and with holes, respectively.

Contract awarded to Francis H. Smith, the lowest bidder, with the approval of the Chief of Engineers.

APPENDIX No. 2.

BATTALION OF ENGINEERS AND ENGINEER SCHOOL OF APPLICATION.

REPORT OF LIEUTENANT-COLONEL H. L. ABBOT, CORPS OF ENGINEERS, BVT. BRIG. GEN., U. S. A., OFFICER IN COMMAND, FOR THE FISCAL YEAR ENDING JUNE 30, 1883.

BATTALION OF ENGINEERS AND SCHOOL OF APPLICATION,
Willets Point, New York Harbor, July 10, 1883.

GENERAL: I have the honor to submit the following as my annual report upon the Battalion of Engineers and the School of Application for the year ending June 30, 1883.

The legal organization of the Battalion is five companies, with an authorized strength of 752 enlisted men, but at present only four companies, with a total strength of 200 enlisted men, are allowed to be recruited. During the past year Companies A, B, and C have been stationed at Willets Point; Company D has existed only on paper, being represented by a single sergeant; and Company E has been stationed at West Point. Two soldiers have served on detached duty in the Military Division of the Missouri.

The aggregate strength of the Battalion on June 30, 1883, was 16 commissioned officers and 181 enlisted men.

ROSTER OF OFFICERS ON JUNE 30, 1883.

Lieut. Col. Henry L. Abbot, Corps of Engineers, commanding.
Capt. William H. Bixby, Corps of Engineers, adjutant.
First Lieut. Eugene Griffin, Corps of Engineers, quartermaster.

Company A.

Capt. E. H. Ruffner, Corps of Engineers, commanding company.
First Lieut. J. G. Warren, Corps of Engineers, with company.
Second Lieut. O. T. Crosby, Corps of Engineers, with company.

Company B.

Capt. J. H. Willard, Corps of Engineers, commanding company.
First Lieut. John Millis, Corps of Engineers, with company.
First Lieut. H. F. Hodges, Corps of Engineers, with company.
Second Lieut. L. H. Beach, Corps of Engineers, with company.

Company C.

Capt. J. C. Mallery, Corps of Engineers, commanding company.
First Lieut. John Biddle, Corps of Engineers, with company.
Second Lieut. Edward Burr, Corps of Engineers, with company.
Second Lieut. G. D. Fitch, Corps of Engineers, with company.

Company D.

Capt. William H. Bixby, Corp of Engineers, commanding company.

Company E.

Capt. William S. Stanton, Corps of Engineers, commanding company,
First Lieut. William M. Black, Corps of Engineers, with company.

ASSIGNMENT, ETC., OF OFFICERS DURING THE YEAR.

Rank.	Names.	Date.	Joined or relieved.	Remarks.
First lieutenant.....	Bixby, William H.....	July 1, 1882	Joined.....	Special Order 147, Headquarters Army, June 26, 1882.
Do.....	Black, William M	Aug. 28, 1882	....do	Special Order 105, Department of West Point, August 29, 1882.
Second lieutenant....	Burr, Edward.....	Sept. 30, 1882	....do	Special Order 177, Headquarters Army, August 1, 1882.
Do.....	Crosby, Oscar T	Sept. 30, 1882	....do	Do.
Do.....	Beach, L. H	Oct. 21, 1882	....do	Do.
Captain.....	Ruffner, E. H	Feb. 1, 1883	....do	Special Order 12, Headquarters Army, January 15, 1883
Second lieutenant....	Fitch, G. D.....	June 23, 1883	....do	Special Order 138, Headquarters Army, June 16, 1883.
Do.....	Brown, E. O.....	July 1, 1882	Resigned ...	Special Order 109, Headquarters Army, May 11, 1882.
First lieutenant.....	Taber, H. S.....	Aug. 28, 1882	Relieved....	Special Order 104, United States Military Academy, West Point, August 28, 1882.
Do.....	Carter, O. M	Oct. 31, 1882	....do	Special Order 246, Headquarters Army, October 21, 1882.
Do.....	Goethals, George W..	Nov. 2, 1882	....do	Do.
Captain.....	Raymond, C. W.....	Jan. 13, 1883	....do	Special Order 1, Headquarters Army, January 2, 1883.
Do.....	Bixby, William H	June 30, 1883	....do	Special Order 145, Headquarters Army, June 25, 1883.

ENGINEER RECRUITING AND DESERTIONS.

The present system of recruiting is insufficient for the needs of the service. Small as our authorized force now is, the numbers are rarely full. At my last annual report 7 men were lacking, and we now require 19 men, or about 10 per cent. of our nominal aggregate strength. So large a deficiency throws extra work upon the remaining soldiers, thus producing dissatisfaction, and cripples the Battalion in its drills and routine of duty, to say nothing of rendering it even less ready for an emergency than would be expected from its paper organization.

Special recruiting for the Battalion has been discontinued since 1874, and vacancies are now supplied by enlisting men applying at Willets Point or West Point, or by the assignment of selected recruits from the general depot at David's Island, the latter requiring special orders from the Adjutant-General, which for several months have not been issued by reason of the demand for recruits on the plains.

Prior to 1874 recruits were obtained by the following system: The Battalion commander, as superintendent of Engineer recruiting, was authorized to open rendezvous at certain cities, such as New York, Boston, Detroit, Saint Louis, Portland, &c. Small parties of engineer soldiers were sent to those stations and, under the orders of Engineer officers stationed there on other corps duty, they sought out recruits. These officers, in addition to their regular duties, performed those of

recruiting officer in charge of rendezvous, and the men were thus enlisted and transferred to Willets Point.

In my judgment the time has come to return to this system upon a small scale. I would recommend that a single rendezvous be opened in New York City, under charge of the Engineer officer stationed there, who can most conveniently perform the duty of recruiting officer. One non-commissioned officer and one or two privates would be sufficient for the detail, and recruits could be sent three times a week to Willets Point on the quartermaster boat without expense. By this change the Battalion could no doubt be kept nearly full, and it is believed that a better class of soldiers could be obtained. With every disposition and effort on the part of the officers at David's Island to aid us in this matter, we occasionally receive poor men—more, probably, than would be had by special enlistment, where a higher standard could be fixed and larger inducements be offered. The cost of such a rendezvous would be small.

The following is a summary statement of the recruiting, &c., for the Battalion during the past year:

Enlisted at Willets Point, 12; re-enlisted at Willets Point, 6; enlisted at West Point, 5; re-enlisted at West Point, 5; recruits from David's Island, 13; deserters apprehended, 1; discharged by expiration of term of service, 24; for disability, 2; by order, 6; transferred to other arms of service, 2; desertions, 20.

The duty of recruiting for Company E at West Point was transferred from the adjutant of the Military Academy to one of the company officers, to be appointed by the commanding officer of the Battalion, by a letter from the Adjutant-General, dated November 11, 1882, thus restoring the old system in force prior to December 6, 1881.

MILITARY DUTIES OF THE BATTALION.

Guard duty at Willets Point is more than usually onerous, because public property which has cost over $3,000,000 is to be protected, not only against fire and land robbers but also against the operations of river thieves, who swarm in the vicinity of the great cities of New York and Brooklyn. This is done by ordinary details from the Battalion, and by special watchmen selected from the companies for their trustworthy character. An electrical system of communication with the guard-house is arranged for hourly reports throughout the night, and as the men are skillful marksmen depredations could be committed only at serious damage to life and limb. The system has proved entirely effective.

The companies are thoroughly instructed as infantry, and have always been called upon with the artillery garrisons stationed in the harbor when needed to quell riots or disorders.

The Engineer troops also perform much useful work in the remodeling of the ponton trains, repairing public buildings, printing and binding confidential Engineer documents, drawing and photolithographing the necessary illustrations for the same, and in carrying on extensive and laborious trials to perfect the system of submarine defense for our chief seaports.

The company stationed at West Point has performed ordinary garrison duties and aided in the instruction of the corps of cadets in field fortifications, military bridge building, and military signaling.

Two enlisted men have served in the Military Division of the Missouri on reconnaissance duty, under the orders of the Engineer officers at-

tached to the staffs of the commanding generals. The details for this duty should be much larger. Frequent applications are made for more men, but until an increased force of Engineer soldiers is authorized, no more can be spared.

THE ENGINEER SCHOOL OF APPLICATION.

As set forth in my previous annual reports, Willets Point has steadily advanced from an ordinary military post to a useful School of Application for the Engineer service, including both commissioned officers and enlisted men.

Officers newly assigned to the corps now serve about two and a half years here with the troops. In addition to the regular routine of company duty, they are instructed practically in as many branches of their profession as the means at hand will permit. We have now a fine field astronomical observatory, torpedo laboratory, photographic laboratory (a new building completed during the past year), with every facility for practice in reconnaissance, surveying, tidal and current measurements, and barometric hypsometry. In military bridge building, military land mining, target practice, and other Engineer field duty, the course is as thorough as the wretchedly inadequate force of enlisted men will permit. To supplement this deficiency the Chatham system of molding room drill in field fortification and sapping was introduced several years ago, use being made of an old temporary building constructed during the war. The success was so marked that upon your recommendation Congress at its last session granted the needful funds, and during the coming year a building nearly circular, and 110 feet in diameter, will be erected for this purpose. This will enable an intelligent study of modern progress in these important matters to be made, and cannot but increase the military efficiency of the Battalion in the next war.

In carrying out this general system of instruction I have been cordially aided by the three captains commanding the companies, and by the adjutant and the quartermaster, who, as a rule, are first lieutenants of several years' experience in the corps; and I may add incidentally that these officers while doing a most useful work in training the recent graduates from West Point and the enlisted men in the special duties of our arm of service, also derive no small benefit themselves in thus at stated intervals returning from the civil duties of the corps and again serving with troops. The old reproach that in time of peace Engineers serve simply as staff officers and civil engineers, thus becoming practically unacquainted with soldierly duties, has no longer any basis.

During the past year the most important advances at the school have consisted (1) in the construction of the new photographic laboratory, and (2) in a change in the mode of instruction of our young officers in submarine mining. Heretofore they have been placed on a regular weekly roster which, during their tour of service, would aggregate about six months of continuous duty. During this time they have every facility to use the apparatus and library, and are required to give the enlisted men much instruction both theoretical and practical. Every assistance they desire is rendered, and they are called upon to aid in any measurements in progress. The examinations for promotion of late years have shown that while in most cases this system has given a satisfactory knowledge of the subject, it has partially failed in others; and during the past winter, with the approval of the Chief of Engineers, a radical change has been made.

The new plan is the following: The summer practice remains un-

changed. For the winter course (December 1 to April 30) the three captains are placed on a roster to assume personal direction of the laboratory for one week in turn. The officers are divided into two classes according to the length of time they have served with the Battalion, and have a prescribed course of reading and experiment. There are two annual examinations before the "Board of Instruction" (the Battalion commander and the three captains), one at the end of January, and one at the end of April. These examinations are thorough, covering the whole prescribed course for the periods in question, and consuming an entire day for each class; and any officer failing to pass creditably would go over the same course again. No officer is reported to the Chief of Engineers as proficient in submarine mining until approved by this Board. This system has been used for the first time during the past winter, and met with marked success. I am satisfied that a more thorough knowledge of the subject has been acquired than ever before, and I desire to express my hearty appreciation of the efforts of both instructors and students to prepare for one of the most responsible duties imposed by Congress upon the Corps of Engineers.

As permitted by the War Department since 1880, a class of artillery officers (Lieut. John L. Chamberlin, First Artillery; Lieut. M. C. Richards, Second Artillery; and Lieut. H. A. Schroeder, Fourth Artillery) have taken a six months' course of study here during the past season to qualify themselves for detail in the torpedo branch of our mining duties. They have followed a prescribed course of reading and experiment, and have passed a very thorough examination at the end of each month before the Board of Instruction named above. These officers have all taken great interest in the subject, and have acquitted themselves to our entire satisfaction, as has been more fully set forth in a special report to the General of the Army already forwarded through regular channels.

I append copies of my Orders No. 10, of 1882, and No. 1, of 1883, which give detailed information as to the scope of instruction at the school, and copies of my Orders No. 12, of 1882, and 6, of 1883, and of numbers 2, 3, and 4, of 1883, which exhibit respectively the results in target practice, in meteorology, in astronomy, and in the winter theoretical instruction of our non-commissioned officers. Attention is invited to all of these orders, which cover the ground concisely, and especially to the target practice and astronomical orders, which exhibit gratifying progress.

The course in military photography during the past year has been under the charge of First Lieut. Eugene Griffin, of my staff; and attention is invited to his report, appended and marked A, for details. Lieutenant Griffin has not only directed this department with skill and efficiency, but has also prepared two valuable technical papers which have been printed on the Battalion press for use here.

The instruction in practical surveying, tidal and current measurements, &c., has been under the special charge of Captain Mallery. Officers serving their first season with the Battalion have each surveyed one square mile carefully, giving 10-foot contours, and a compilation of previous work has been made, forming a useful and accurate military map, covering about 15 square miles in the vicinity of this post. The officers serving their second year made a hydrographic survey of Little Neck Bay and a series of tidal measurements, but they were relieved from duty here before completing the current observations.

Captain Willard has had direction of the practical course in pontoniering and military mining, including a series of experiments in the

use of dynamite in camouflet work, and the preparation and explosion of a land mine. The practice in the molding room, as heretofore, has yielded excellent results under the direction of the three company commanders, each regulating the drill of his own company. The construction of the model Vauban front in masonry upon a scale of $\frac{1}{12}$ has at last been essentially completed, through the exertions of Lieutenant Bixby and Captain Willard. The practice in military reconnaissance and drills in infantry tactics under the company commanders, as usual, has been excellent.

In field astronomy my thanks for zealous assistance are due to Captain Raymond in 1882, and Captain Ruffner during the present season. I think the facilities at Willets Point for becoming conversant with practical field astronomy are unequaled in the United States.

The great need of the school at present is an increase in the numbers of the enlisted men. At present this force is reduced so far below the legal standard that it is impracticable to properly train the soldiers in many of their war duties. This matter has been so often urged by yourself and the honorable Secretary of War that I need only refer to it as a matter of primary importance. It is well understood that our Regular Army must always be small in time of peace, but the special branches requiring long training for reasonable efficiency cannot safely be neglected as at present. It is easy to raise regiments of volunteer infantry able to serve effectively after a short experience. Even as cavalry and field artillery, much good work was done in the civil war after a few months of fighting. But, to say nothing of other Engineer duties, the torpedo defense of our sea-coast demands serious attention. At present not more than 100 men, qualified by technical knowledge to be intrusted with the work, could be found in this country. England maintains a larger force of Engineer soldiers in American waters than ourselves; and if sea mining alone demanded attention, the full strength of the Battalion as authorized by law (752 enlisted men) should be kept under the colors.

Very respectfully, your obedient servant,

HENRY L. ABBOT,
Lieut. Colonel of Engineers,
Bvt. Brig. General, U. S. A., Commanding.

General H. G. WRIGHT,
Chief of Engineers, U. S. Army.

A.

UNITED STATES ENGINEER SCHOOL OF APPLICATION,
PHOTOGRAPHIC DEPARTMENT,
Willets Point, New York Harbor, June 11, 1883.

SIR: In accordance with your instructions, I have the honor to forward herewith a report upon the results obtained in the photographic department of this school during the past year.

The new photographic building has been completed and was occupied early in May, 1883. It is a most commodious and convenient building, and affords every facility for the study of the different processes in photography.

During the winter seven officers have been on the detail for instruction, each tour of duty being two weeks. The delay in the completion of the new building, and the confusion incident upon moving, made it impossible to pursue the course as systematically as had been intended, but it is expected that another year will show much greater progress. The reports of the several officers under instruction, which have been forwarded by me, will show, however, that notwithstanding the difficulties encountered, each officer has satisfactorily completed the course.

I would recommend that the officers be not required hereafter to explain the different processes in detail in their yearly report, as most of these processes are now fully given in different printed papers, of which each officer has copies. They should, however, state the nature and extent of the work they have done; the result of their experience as developing advantageous changes in formulæ or methods; the methods of overcoming difficulties not fully explained in the text books; and, in general, anything which they might deem worthy of record and preservation.

The non-commissioned officers of the Battalion have all received careful instruction; and during the summer the four who have shown the most aptitude are placed on a roster for special instruction.

In the fall of 1882 a press and complete outfit were obtained from the Boston Heliotype Company, for photo-mechanical printing, and the autoglyph method with copper plates has been developed with most satisfactory results. Nearly all the works issued from the Battalion printing office are now illustrated by excellent autoglyphs or photolithographs.

In conclusion I would state that the officers and non-commissioned officers have all shown a gratifying interest in their work. Great credit is due Sergeant Von Sothen, the assistant instructor, for his really excellent work with copper plates and for his faithful devotion to his duties in the laboratory.

I am, very respectfully, your obedient servant,

EUGENE GRIFFIN,
First Lieutenant of Engineers,
Instructor of Photography.

Lieut. Col. HENRY L. ABBOT,
Corps of Engineers,
Commanding U. S. Engineer School of Application.

[Printed Orders No. 10.]

BATTALION OF ENGINEERS,
Willets Point, New York Harbor, November 9, 1882.

I. Officers of the Battalion who have not already submitted the reports and papers required by Printed Orders No. 4, current series, will forward them as soon as possible, in order to expedite the publication of the results of the summer's work.

II. The following will be the course of winter instruction at the Engineer School of Application during the ensuing season, beginning on the 4th proximo.

WILLETS POINT, NEW YORK HARBOR.

In the torpedo service.—This course for officers is perhaps the most important of any at Willets Point; and as it includes much theoretical as well as practical matter not taught at West Point, experience has shown that it may advantageously receive more direction than heretofore. The following system is accordingly established.

The laboratory course (from December to April, inclusive) is, under the personal supervision of the Battalion commander, placed under the special charge of the three captains, who are removed from the roster as officers of the day, and constituted a Board of Instructors. One of them, in weekly rotation, will be present during the hours of duty, beginning one hour after guard mounting. He will be in military command of the building and of the details of officers and enlisted men, and will direct the course of reading, experimental practice, and drill of the entire establishment. He will be responsible that the instruments are properly used and kept in order; that silence is maintained in the library when occupied for study; and that the time of every one is employed profitably upon the course.

There will be two stated examinations before this Board, one at the end of January and the other at the end of April; and, in addition, such examinations of the annual artillery detail as are required by existing orders.

Engineer officers studying the course are divided into two classes—those of the first and those of the second season of duty with the Battalion. Each officer will thus have four regular examinations—having passed which satisfactorily his future studies in submarine mining will be arranged by himself. The first examination will cover Part I of the Torpedo Manual, omitting Chapter IV, and will include a set of observations and measurements as prescribed therein, the notes of which must be submitted to the Board. The second examination will cover the same, with Parts II and III of the Manual. Samples of all mechanical work therein prescribed must be executed personally by the officer and submitted. It will also cover every practical detail of

the duty of electrician in setting up his apparatus, making the tests, &c. The third examination, in addition to the above, will cover the Report upon the Experiments and Investigations conducted at Willets Point to develop our system of Submarine Mining. The fourth examination, in addition to the above, will cover the Professional Papers of the Engineer School of Application treating of submarine mining, together with a full discussion of foreign systems as described in the writings of Stotherd, de Sarrepont, Vandervelde, Sleeman, and others, in the library of the torpedo laboratory. No officer will be reported to the Chief of Engineers as proficient in this course until he has passed through these four examinations in a manner satisfactory to the Board of Instructors.

During the coming season the first examination of the second year will include the first two prescribed above; and the second, the third.

The following will be the roster for the coming season, which includes 21 weeks. It is arranged to give each officer 14 weeks for his first winter of service with the Battalion, and 7 weeks for his second winter. The details will not interfere with tours as officer of the day, but will exempt from details on regimental and garrison courts-marshal and boards. Officers will proceed to the laboratory at guard mounting daily, except on Saturdays and Sundays, and will remain there not less than six working hours.

Lieutenant Bixby is omitted from the roster to enable him to prepare his report to the Chief of Engineers upon his recent inspection of the modern system of sea-coast defense in Europe; and Lieutenant Griffin, because regular attendance would interfere with his duties as instructor in photography. Each of these officers may make any use of the laboratory for which he finds leisure.

WEEKS OF DETAIL ON TORPEDO DUTY.

Lieutenant Millis: 1, 4, 7, 10, 13, 16, 19.
Lieutenant Biddle: 2, 5, 8, 11, 14, 17, 20.
Lieutenant Hodges: 3, 6, 9, 12, 15, 18, 21.
Lieutenant Warren: 1, 4, 7, 10, 13, 16, 19.
Lieutenant Burr: 1, 2, 4, 5, 7, 8, 10, 11, 13, 14, 16, 17, 19, 20.
Lieutenant Crosby: 2, 3, 5, 6, 8, 9, 11, 12, 14, 15, 17, 18, 20, 21.
Lieutenant Beach: 1, 2, 4, 5, 7, 8, 10, 11, 13, 14, 16, 17, 19, 20.

The instruction roster of non-commissioned officers, arranged in regular rotation, will be kept by the adjutant—one being detailed weekly. The details of privates will be made from the companies in turn and will consist of 6 men. This detail will spend the regular fatigue hours daily, Saturdays and Sundays excepted, at the laboratory or torpedo depot. Every soldier not excused by orders from the Battalion commander will be included on the list. Their instruction will be directed by the captain in charge—who will be assisted by lieutenants on the detail serving their second winter with the Battalion, and by Sergt. W. H. Brown, assistant instructor in submarine mining.

Their instruction will comprise telegraphing with the dial instrument, including the code for action; the duties of the loading-room, and, so far as practicable, of the boat service as prescribed in the Torpedo Manual—comprising preparing the plugs of the buoyant and ground torpedoes; charging the mines; charging the cut-off boxes, three methods; jointing the cores; making turk's heads in the electrical cable; using the junction boxes; attaching a cable stop; splicing and knotting hemp rope; inserting thimbles in the wire mooring rope. They will also receive from an officer who has completed his first year's course *daily verbal instruction* respecting the fuses, explosives, torpedo material (except that of the operating room), voltaic batteries, simple electrical testing, and the use of the portable apparatus for the electrical ignition of mines. On the Saturday terminating his tour, the captain in charge will submit a report, giving the names of the detail, what *verbal* and other instruction they have received, figures showing the insulation of the core-joints made by them, and their absolute proficiency. Printed blank forms will be supplied.

In field photography.—The building, apparatus, chemicals, &c., are in charge of Lieutenant Griffin, Battalion quartermaster, whose duty it is to furnish any desired assistance, and who will be held responsible for the judicious use of the property.

Officers not on the following roster may, at their option, use the laboratory on Saturdays; making such arrangements with him as will avoid confusion in his official duties.

Officers on the following roster for instruction will proceed to the photographic laboratory at guard mounting daily, Saturday and Sunday excepted, and spend not less than six hours there on duty. This detail will not interfere with regular tours as officer of the day, but will exempt from service on regimental and garrison courts-martial and on boards.

WEEKS OF DETAIL ON PHOTOGRAPHIC DUTY.

Lieutenant Millis: 2, 3, 8, 9, 14, 15, 20, 21.
Lieutenant Biddle: 1, 3, 4, 9, 10, 15, 16, 21.
Lieutenant Hodges: 4, 5, 10, 11, 16, 17, 19, 20.
Lieutenant Warren: 2, 3, 8, 9, 14, 15, 20, 21.
Lieutenant Burr: 6, 12, 18, 21.
Lieutenant Crosby: 1, 7, 13, 19.
Lieutenant Beach: 6, 12, 18, 21.

The course of instruction will be arranged to cover: (1) making negatives with gelatine emulsion plates, including the preparation of developers, intensifiers, and other solutions; (2) silver printing, including the preparation of all necessary solutions, finishing and mounting the prints; (3) map printing, including the preparation of glass and paper negatives, the blue process, &c.; (4) photo-lithography, including the preparation of the negatives by the wet-plate process, the preparation of the prints, the transfer to the stone or zinc plates, and the mechanical process of printing; (5) miscellaneous work, such as the heliotype process, &c.

At the close of the season each officer will submit, through Lieutenant Griffin, a personal report upon the work he has accomplished. This paper will be returned to him, with indorsements, for his own files; and it is suggested that it be so prepared as to constitute part of the professional journal required by the corps order regulating examinations.

Two non-commissioned officers from the companies, in turn, will be detailed for instruction for one week, Saturday and Sunday excepted. One will be selected from the following list:

Company A:	Company B:	Company C:
Corporal Wunder.	Corporal Griffin.	Sergeant Turner.
Corporal Doyle.	Corporal Neid.	Corporal Grenier.

The other will be taken in turn from the remaining non-commissioned officers of the company. Attendance will include the usual fatigue hours, and the instructor, aided by Sergeant von Sothen, assistant instructor in photography, will prescribe such work as may be best suited for the individuals.

In field astronomy.—The daily observations of the officer of the day for time, and work in the observatory after each officer has completed the course prescribed in Printed Order No. 4, current series, will be suspended until the resumption of drills.

In meteorology.—The usual hourly meteorological observations at Willets Point will begin on January 2, 1883, and will continue for sixty consecutive days. Officers will take advantage of this opportunity to make themselves familiar with the contents of Professional Paper No. 15, of the Corps of Engineers, treating of meteorology and barometric hypsometry.

The three captains, each acting for ten days in turn, are charged with the supervision of these observations. They will make daily inspection of the instruments, and see that they are kept at all times in perfect condition. They will critically inspect the observer not less than once a day; ascertain, by questions and by examining the plots and records, that he understands and performs his duty; and, if necessary, will give him detailed instruction. At the end of each tour of ten days, they will submit a report to the commanding officer, giving the names of the several observers, the number of times each has been inspected, and a full statement of his relative and absolute proficiency.

The observers will consist of the lieutenants on company duty with the Battalion at this post, and of the requisite number of non-commissioned officers from each of the three companies, to be selected by the captains. Each tour will consist of two consecutive days; the observers will be excused from all other duty during that period, but will make all reductions and plotting pertaining to their records *correctly* and *at once*. Observations between the hours of 12 p. m. and 6 a. m., both inclusive, may be omitted. The roster of companies will be kept by the Battalion adjutant.

Immediately after the termination of the observations, the data will be fully and intelligently discussed upon Colonel Williamson's system, by aid of the daily plots and diagrams and under the supervision of the captains, by the lieutenants of the companies. To Company A is assigned the reduction of the observations with the psychrometer, including force of vapor and relative humidity; to Company B those with the aneroid barometer and of the air temperature; and to Company C those with the mercurial barometer, and of the winds and clouds. Should this reduction develop culpable want of accuracy on the part of any observer, his name will be reported by the captain in charge, in transmitting the final tables and diagrams.

In infantry.—Company commanders will see that their companies are kept well drilled in the manual of arms, and that they are practiced in the bayonet exercise, gallery, target practice, and, when *the weather is suitable in estimating distances.* The hours of practice

and recruit drills will be regulated as may be most convenient. One company drill will be had at 3 p. m. on Friday of each week—recall being beaten at 2.30 p. m. for that purpose; the drill will be attended by all men supplied with muskets, except the foregoing details, and men actually on necessary duty that will not admit of delay.

Theoretical instruction.—The non-commissioned officers of each company, in turn, will be detailed for one week for theoretical instruction. They will be excused from all duties but those necessary in the company, and will attend all recitations unless excused by the surgeon. The only exceptions to this detail will be the police sergeant, the depot sergeant, the acting drum major, the sergeant in charge of the printing office, and the assistant instructor in photography. The hours of the post school will be regulated accordingly when the teacher is on the detail.

Recitations will be conducted daily (Saturdays and Sundays excepted) at such hours as may be selected by company commanders. The latter will be the instructors of the companies, their subalterns being assistants. Regular classes will be formed in field fortification (including mining); pontoniering; topographical drawing; infantry tactics; the theoretical and practical use of the railroad transit; military signaling; and submarine mining according to the three parts of the Manual. The instruction in electricity will include elaborate verbal explanations and experiments in the electrical laboratory, which will be open on Mondays and Tuesdays for this purpose.

Each recitation will be marked on the West Point system; and, at the close of each week, a list showing the marks of each non-commissioned officer, in each branch, will be forwarded to the Battalion adjutant.

During the winter season the school for soldiers, ordered by act of Congress, approved July 28, 1866, and announced to the Army in General Orders No. 56, dated War Department, A. G. O., August 1, 1866, will be established. Attendance will be voluntary, the object being to extend aid to such enlisted men as desire to devote a portion of their winter's leisure to study. The necessary fuel for warming the rooms will be furnished by the Quartermaster's Department, as authorized by General Orders No. 94, series of 1867, from the headquarters of the Army.

This school, as well as that for the children of the post, will be under the charge of the Battalion adjutant. Sessions will be held between 7 and 8 p. m. on Tuesdays, Thursdays, and Fridays of each week. Weekly reports will be rendered, similar to those of the non-commissioned officers' recitations.

WEST POINT, NEW YORK.

Unless otherwise ordered by the Superintendent of the Military Academy, the non-commissioned officers and privates of Company E will receive, so far as practicable, the same instruction as the rest of the Battalion; and a consolidated report of the recitations of the non-commissioned officers in each branch will be forwarded to the adjutant, at the close of the season.

By order of Lieutenant-Colonel Abbot:

W. H. BIXBY,
First Lieutenant of Engineers, Adjutant.

[Printed Orders No. 1.]

BATTALION OF ENGINEERS,
Willets Point, New York Harbor, April 9, 1883.

The following will be the course of instruction and drills for the Battalion of Engineers during the coming season.

WILLETS POINT, NEW YORK HARBOR.

Officers in charge.—The following assignments to special duties other than those pertaining to their military commands are announced for the coming season at the Engineer School of Application. The officers named will be excused from duty as officer of the day.

Captain Ruffner: To take charge of the Repsold base apparatus and of the observations at the astronomical observatory; and to supervise the computations—the results of which will be submitted through him in a weekly report.

Captain Mallery: To take charge of all surveys, other than the company practice in reconnaissance, and of the tidal and current measurements, and of the compilation of the accurate map of the vicinity of Willets Point; and to act as captain of the Battalion team for the matches at Creedmoor.

Captain Willard: To direct the experiments in military mining and the practice in

pontoniering; and to take charge of the completion of the model Vauban front, and of the construction and breaking of a temporary bridge.

Lieutenant Bixby is excused from all special duties in order to enable him to complete his report upon modern iron defences in Europe.

Lieutenant Griffin: To continue in charge of the photographic laboratory.

In military engineering.—1st. Verbal instruction by the company officers in the nomenclature and dimensions of the siege battery and model fronts of fortifications, including the reasons therefor. 2d. The completion of the model Vauban front in masonry, upon a scale of 1 inch to 1 foot. 3d. A course of instruction in the molding room, including the making of modern siege batteries and saps upon a scale of 1:6. This drill will be by company, each in turn being entitled to the use of the room for one month. A commissioned officer of the company must always be present. 4th. A full course of trestle and wooden ponton drill, including boat maneuvers. For this drill the companies will be consolidated under command of Captain Willard, two lieutenants being detailed by the Battalion adjutant in turn. 5th. The construction and experimental breaking of a temporary wooden bridge over a dry ravine. 6th. The preparation and firing of a military mine. The shaft of the mines exploded in 1877 will be used for this purpose.

In the torpedo service.—As heretofore, practical instruction in the service of torpedoes will be given under special directions from the lieutenant-colonel commanding. A weekly detail of two commissioned officers will be made. Company commanders and Battalion staff officers will spend six hours, and lieutenants on company duty seven hours daily on this duty (Saturday and Sunday excepted). They will be excused from all other duties, except dress parades and inspections, and will be governed by General Orders No. 4, series of 1873, from Battalion headquarters.

A weekly detail will be made of 2 non-commissioned officers from the Battalion, each to serve for two consecutive weeks, but not together, and of 6 privates from the companies in turn. These details will be so arranged as to include, in succession, every man in the Battalion not especially excused by the commanding officer. On certain specified weeks this detail will be constituted entirely of non-commissioned officers, when special attention will be given to covering the entire ground as nearly as possible.

During fatigue hours (except on Saturday and Sunday) the men will be under the orders of the senior commissioned officer of the torpedo detail, whose duty it is to see that, when not engaged in assisting in the torpedo trials now in propress, they are instructed (1) in the duties of the boat service, and (2) in those of the loading-room as prescribed in the proof edition of the Manual.

The following system will be observed as closely as the weather permits. Any omitted drill will be had on Friday if possible:

1st. MONDAY. *Judgment torpedo drill.*—The mapping drill will first be practiced—then the judgment firing drill. A few steamers or sailing vessels should be tracked at every drill, and the diagrams will be neatly finished and preserved.

2d. TUESDAY. *Placing the junction boxes.*—This drill will be simulated on land until the principles are fully understood by every member of the detail. It will then be executed in the river, using the base line between the fort and Engineer wharf. Care must be taken, by providing buoy ropes of sufficient length, to avoid the loss of anchors.

3d. WEDNESDAY. *Planting single mines.*—One weekly drill will be had in planting and raising a buoyant mine; and another in planting and raising a ground mine of the model of 1873. The steam-launch will be used for this purpose.

4th. THURSDAY. *Automatic firing drill.*—This drill must first be practiced at the wharf, in the manner prescribed in the manual. Subsequently, if desired by the officer in charge, it may be combined with the judgment drill on the river.

5th. *Daily instruction in rowing.*—This drill (weather permitting) will be under the direction of Lance-Corporal Lane, Company C, assistant instructor in submarine mining, and will be had between morning fatigue call and 8.30 a. m.

6th. In unfavorable weather, the detail will be exercised in the duties of the loading-room, in the shore duties pertaining to the boat service, and in the use of the dial telegraph. The senior officer of the detail will also give verbal instruction respecting the fuses, explosives, torpedo material—except that of the operating room—simple electrical testing, and the practical use of the ordinary forms of apparatus for the electrical ignition of mines. This may be done in the torpedo museum, by reading and elaborating portions of the text of the Manual.

In giving this instruction, the senior officer of the torpedo detail will be aided by the junior officer. In their absence, Sergt. William H. Brown, Company A, senior assistant instructor in submarine mining, will be in general charge of the detail.

On the Saturday terminating his tour, the senior officer will submit the plots of the mapping drills, and a report giving the names of the detail, what they have been drilled in, and their classification as to proficiency. Printed blank forms will be supplied.

Before the end of the season, the grand group of mines planted in 1881 will be raised and replanted, and trial runs and dock trials with the fish torpedo and experiments with new explosives will be continued—under special directions from the lieutenant colonel commanding.

In military map-making.—Each lieutenant on company duty who has not already done so, and each non-commissioned officer and five selected privates from each company, will make a satisfactory foot reconnaissance, at least five miles long, in the vicinity of the post. The instructions laid down in General Orders No. 12, series of 1868, from these headquarters, will be strictly followed, including the contouring. Especial attention will be given to *making the scales correctly;* (1) no attempt being made to change the natural length of step in the field work; (2) the plot being made in terms of this natural unit; (3) its absolute length being determined carefully by pacing several times over a known distance; and (4) a correct scale being constructed from these data, with 100 yards as the unit, the zero being between the first and second divisions on the left, and the first division being subdivided into ten equal parts. The plot will distinctly show the *beginning and end of the reconnaissance,* without any attempt at compromising discrepancies.

The captains will be the instructors in these reconnaissance drills; and they will submit to these headquarters, *on or before the termination of the season,* the several maps and drawings—each duly approved by themselves.

Each lieutenant on company duty, who has not already done so, will make and plot a careful instrumental survey of at least one square mile of ground on the peninsula of Great Neck—connecting with the former surveys in that vicinity. The work will include contours with a surveyor's level. He will be assisted in the field work by details of non-commissioned officers and privates from his company. The work will be plotted on a scale of 12 inches to the mile with contour plans 10 feet apart; and may be executed upon any recognized system preferred by the officer. Good level benchmarks should be made and located on the map, the references being given in a column of notes. The names of residents should be recorded. The finished maps will be submitted on or before the termination of the drill season.

An extension of the careful hydrographic survey of last season towards the main channel will be made by the lieutenants on company duty serving their second year with the Battalion.

These instrumental surveys will be executed under the direction of Captain Mallery. They will begin at once, and officers will be excused from all other duty when detailed for this purpose. The detail will be made by the adjutant upon the application of Captain Mallery, and will take precedence over other rosters.

In field photography.—The officers' laboratory will be open daily from 1.30 p. m. until 4 p. m. The building, apparatus, chemicals, &c., will be under the charge of Lieutenant Griffin, Battalion quartermaster, whose duty it is to furnish any desired assistance, and who will be held responsible for the judicious use of the property.

Officers are invited to avail themselves of the advantages of the laboratory, making such arrangements with the officer in charge as shall insure no confusion in his official duties, or in those of the men under his instruction.

The instruction of non-commissioned officers will be restricted to the following class, selected from those who have displayed special aptitude during the winter course. They will be detailed singly for one week in turn; and will receive such instruction as, in the judgment of the officer in charge, is best suited to perfect their knowledge of the subject.

DETAIL OF NON-COMMISSIONED OFFICERS.

Company A.	Company B.	Company C.
Corporal Wunder.	Corporal Griffin.	Sergeant Turner.
		Corporal Grenier.

In field astronomy.—All the lieutenants who have not already completed the course, and been excused from further observations, will constitute the observers, a roster being kept by the adjutant. In addition, when officer of the day (except on Sundays, and weather permitting), they will observe the sun or stars for time. These observations will be computed at once in the book prepared for the purpose, and the error of the *mean solar* chronometer will be distinctly recorded there and on the guard report, where, in case no observations are taken, the cause should be stated.

The following system will govern the observations at the observatory. The course covers two seasons—the first including sextant work, and transit and zenith telescope work with the instruments in the east wing and on the outer pier; and the second including sextant work, practice with the new combined instruments in the west wing, and with the equatorial. Advantage will be taken of every suitable night for observing. Officers wishing to use the instruments for special observations or practice must apply for authority to do so.

Officers will usually be detailed for astronomical duty for one week in turn, but in

case of bad weather the roster will be arranged so as to give each an equal chance to accomplish the work required of him early in the season; when this work is completed, and when in the judgment of the instructor he has become an expert observer, his name will be removed from the roster.

Special note-books will be provided for each officer; which, after the end of the season, and inspection by the commanding officer, will become his personal property. Suitable blank forms will be printed, both for observations and computations; and these forms will be pasted into the books, thus rendering them valuable for future reference.

The computations will receive special attention (1) as to methods employed; (2) as to the values adopted for the instrumental constants; and (3) as to rejection of doubtful observations. The latter is more than usually important, because knowledge of the correct results is likely to bias the judgment. The following rules will be strictly observed: No correction of the original record is to be made subsequently; if clearly wrong the observation must be rejected. No rejection of an observation is allowed, unless (1) it was marked doubtful at the time; (2) it is thrown out by Peirce's criterion; or (3) its discrepancy is so largely in excess of any probable limit as to render some exceptional cause certain—for instance, a discrepancy of 1 minute in a zenith telescope latitude. Every rejection under this third case must receive the approval of the officer charged with supervising the computations.

The following allowance of time will be made for computations: Three days for a set of latitude observations with the sextant, for a set of time observations with the transit, for a longitude by Jupiter's satellites, for the value of a level division or for a micrometer turn with the zenith telescope; ten days for a longitude by moon culmination or by lunar distances, or by an occultation by the moon or for latitude by the zenith telescope. *These limits as to time must be strictly observed and daily reports will be submitted in writing to the instructor explaining the reason of any delay.*

The following will be the ordinary routine of observations with the several instruments.

SEXTANT.—After becoming skillful in the use of this instrument upon the sun, observers will deduce at least one satisfactory latitude by observing a north and a south star, using the time deduced from an east and a west star—each based on ten altitudes taken on the same night. Finally, they will deduce one longitude by the method of lunar distances—computed by Chauvenet's method. These observations are not included in the regular roster, but will be made when officer of the day or at such other times as may be convenient.

TRANSIT.—A set of time observations for rating the chronometer will be made about once a week, observing a star above and a star below the pole for deviation, and about five south stars for time. Occasionally an observation on a slow circumpolar star will be made for determining the collimation constant. Every moon culmination occurring before 1 a. m. will be observed, until each officer has secured at least one satisfactory result.

At first, time will be recorded by the instructor; then the observer will take his own time; lastly, the field chronograph will be used.

ZENITH TELESCOPE.—Observers will first determine the level correction by daylight, using a distant terrestrial object, or at night using a slow circumpolar star. They will then find the value of a turn of the micrometer by observing Polaris at elongation. Lastly, they will observe for latitude, until they have obtained a satisfactory determination based on three nights' work upon not less than twenty pairs.

THE COMBINED TRANSIT AND ZENITH TELESCOPE.—These instruments will be used only after the observer has become thoroughly expert with the simpler forms—the object being to give familiarity with the latest special patterns in use by the Corps of Engineers.

EQUATORIAL TELESCOPE.—Every practicable occultation of a star of the sixth or higher magnitude by the dark limb of the moon will be observed; also every eclipse of Jupiter's satellites, either with this instrument or with an astronomical telescope, until each officer has obtained one satisfactory result. Suitable lists will be prepared in advance, so that no opportunity may be lost.

In field magnetic observations.—This course is for officers serving their second year with the Battalion, and will be carried out as fully as the facilities at hand will permit.

In the use of the Repsold base apparatus.—Practice will be had with this apparatus by officers serving their second year with the Battalion.

In tidal and current measurements.—This course will comprise observations with the self-registering tide-gauge, with the electric current-meter, and with double floats. It will be confined to officers serving their second year with the Battalion, and will include a full set of observations and a discussion of the same.

In infantry.—Instructions in the revised infantry tactics, including the school of the soldier, the company, and the battalion; and in target practice according to a sys-

tem based upon Laidley's Manual of Instruction in Rifle Firing, and defined in Battalion Orders Nos. 7 and 11, series of 1880.

A commissioned officer of the company must be present at and supervise all target practice, unless specially excepted by orders from the commanding officer of the post.

WEST POINT, NEW YORK.

It is desired that, so far as circumstances will permit, the men of Company E, stationed at West Point, may receive instruction similar to that of the rest of the Battalion. The company commander at the end of the season will report fully how far this has been practicable.

By order of Lieutenant-Colonel Abbot:

W. H. BIXBY,
First Lieutenant of Engineers, Adjutant.

APPENDIX No. 3.

ENGINEER DEPOT AND POST OF WILLETS POINT.

REPORT OF LIEUTENANT-COLONEL H. L. ABBOT, CORPS OF ENGINEERS, BVT. BRIG. GEN., U. S. A., OFFICER IN COMMAND, FOR THE FISCAL YEAR ENDING JUNE 30, 1883.

ENGINEER DEPOT AT WILLETS POINT,
Whitestone P. O., Queens County, New York, July 1, 1883.

GENERAL: I have the honor to submit the following as my annual report upon the Engineer Depot and Post of Willets Point, for the fiscal year ending June 30, 1883.

PUBLIC BUILDINGS.

The only new construction during the year has been the photographic laboratory, for which a special appropriation was made by Congress. The building is now complete and in active operation. The total cost, including tanks, sinks, shelving, tables, dark-room furniture, &c., has been $5,868.69. It is admirably adapted to its purpose, containing duplicate sets of rooms for practice in photography (one for officers and one for enlisted men), and a single set for lithography and photo lithography. All the illustrations required for the confidential engineer documents for several years past have been drawn and printed by Engineer soldiers at trifling cost, and with the facilities afforded by this building, more and better work can be done.

As heretofore, much labor in the way of repairs to temporary buildings has been performed by the Engineer troops, the materials being supplied by the Quartermaster Department on requisitions.

PROPERTY IN DEPOT.

The instruments, tools, and miscellaneous Engineer property in depot have been guarded, received, and issued by the Engineer troops upon the system detailed in my former annual reports.

The rooms in the fire-proof building containing valuable instruments (capacity 37,000 cubic feet) have been kept dry by the use of calcium chloride, in the manner adopted and reported several years ago. The dampness of the climate renders this an important matter; about 111 gallons of water having been removed from the air of these rooms during the past year, as appears from the following table. Before this system was inaugurated it was found impossible to protect the instruments against rust.

Drying by calcium chloride.

Date.	Weight of solution.	Weight of anhydrous salt.	Difference.	Amount of water.
	Pounds.	*Pounds.*	*Pounds.*	*Gallons.*
July 19, 1882	285	180	105	12.6
August 25, 1882	238	181	57	6.8
August 25, 1882	293	178	115	13.8
September 21, 1882	257	142	115	13.8
November 2, 1882	222	159	63	7.6
January 15, 1883	280	152	128	15.3
June 11, 1883	272	165	107	12.8
June 12, 1883	272	165	107	12.8
June 28, 1883	272	145	127	15.2
Total	2,391	1,467	924	110.7

The work of remodeling the bridge equipage in store to make it conform to the present approved pattern has been continued during the past winter by a small detail from the Engineer Battalion. Four new model chess wagons have been reconstructed from five old ones by three men at a total cost of $66.15 for extra-duty pay. The work, which is very considerable and requires skilled labor, has been well executed.

The printing office, as usual, has been in active operation during the entire year. Several important Engineer documents of a confidential character have been printed and bound, and much other work of like character has been completed. Four soldiers have been engaged on this work, receiving $396.55 as extra duty pay. Two of them have learned the trade since enlistment, and are now skilled printers, able to set up difficult table work.

The receipts and issues of instruments for the use of officers of the Corps engaged in geodetic, astronomical, and other work of like nature have been extensive, as appears from the following table, which shows an average of about four transfers per day during the entire year:

Statement of receipts and issues of instruments for the Engineer Depot, Willets Point, New York Harbor, for 1882–'83.

Articles.	Received.	Issued.	Articles.	Received.	Issued.
ASTRONOMICAL.			MAGNETIC.		
Astronomical transits ..... number..	4	.....	Theodolite magnetometers.. number.	2	1
Astronomical clocks ..... do....	2	.....	Declinometers ..... do...	2	1
Astronomical telescopes ..... do....	2	.....	Dynameters ..... do...	1	.....
Zenith telescopes ..... do....	4	.....	Bar-magnets ..... pairs.	2	.....
Oil cloth cover ..... do....	1	.....	Dip-circles ..... number.	4	1
Chronometers ..... do....	10	5	Bobbin, unspun silk ..... do...	1	.....
Chronometers, break-circuit ... do....	10	.....			
Reflecting circles ..... do...	1	.....	METEOROLOGICAL.		
Sextants ..... do....	11	3			
Artificial horizons ..... do....	20	3	Barometers, aneroid ..... number.	29	5
Chronographs ..... do....	4	.....	Barometers, mercurial cistern.. do...	43	3
Relays, magnets, sounders, and keys ..... sets..	7	.....	Barometers, cases of instruments, for repairs of ..... number.	7	1
Break-circuit keys ..... number..	10	.....	Rain-gauges ..... do...	1	.....
Switch-boards ..... do....	3	.....	Psychrometers ..... do...	17	3
Telegraph keys ..... do....	1	1	Thermometers ..... do...	31	8
Telegraph instruments ..... do....	3	.....	Thermometers, deep-sea ..... do..	4	.....
Lanterns ..... do....	7	.....	Thermometers, standard ..... do...	7	.....
Mercury bottles ..... do....	.....	1	Thermometers, maximum ..... do...	20	.....

Statement of receipts and issues of instruments, &c.—Continued.

Articles.	Received.	Issued.
METEOROLOGICAL—Continued.		
Thermometers, minimum...number..	20	.....
Hygrometers .....do....	1	.....
GEODETIC.		
Compasses, solar .....number..	.....	1
Compasses, surveyors'.....do....	.....	4
Theodolites, 12-inch and upward, number	3	.....
Theodolites, medium .....number..	26	15
Theodolites, 3-inch.....do....	3	2
Plumb-bobs for large theodolites, number	10	.....
Trivets .....number..	17	.....
Gradienters.....do....	1	.....
Heliotropes.....do....	8	.....
Levels, surveyors'.....do....	3	7
Kern level rods in, box .....do....	3	3
Level rods .....do....	1	5
Level targets .....do....	.....	3
Plane tables.....do....	3	2
Standard meter .....do....	1	1
Standard yards.....do....	7	.....
Standard inch .....do....	1	.....
Arithmometer .....do....	1	.....
Planimeter.....do....	1	.....
Base apparatus, primary.....do....	2	.....
Base tubes, secondary .....do....	2	.....
Base-line rods .....do....	3	.....
Comparators .....do....	2	.....
Chains, 100 feet .....do....	.....	4
Chains, 66 feet .....do....	2	1
Chains, 50 feet .....do....	11	9
Chains, metric .....do....	15	1
Pins.....sets...	27	9
Tapes, steel.....number...	8	1
Current meters.....do.....	1	.....
Rods, surveyors' .....do.....	.....	3
Self-registering tide-gauges ...do.....	3	3
Sounding indicators.....do.....	3	.....
RECONNOITERING.		
Spy-glasses, small .....number...	22	6
Telescope, with micrometer...do.....	1	.....
Binocular field glasses.....do.....	6	4
Odometers .....do.....	22	.....
Compasses, boat .....do.....	12	.....
Compasses, prismatic.....do.....	12	16
Compasses, box .....do.....	16	.....
Compasses, pocket, square.....do.....	17	36
Compasses, round .....do.....	14	.....

Articles.	Received.	Issued.
RECONNOITERING—Continued.		
Hand-levels, swinging .... number..	1	.....
Hand-levels, reflecting .....do....	9	5
Pocket sextants.....do....	1	1
Watches .....do....	8	.....
Passometers .....do....	1	.....
DRAWING.		
Protractors, circular.....number..	.....	2
Protractors, wooden, horn, &c do....	7	.....
Protractors, Abbot's.....number..	10	17
Drawing instruments .....boxes..	27	6
Dividers.....number..	4	.....
Proportional dividers.....do....	1	.....
Beam compasses .....do....	2	.....
Scales, boxwood, triangular...do....	21	2
Scales, metric, metallic .....do....	21	.....
Scales, metric, ivory.....do....	5	.....
Scales, metric, wooden.....do....	14	.....
Scales, foot, metallic.....do....	9	.....
Scales, foot, ivory .....do....	3	.....
Scales, calculating .....do....	1	.....
Scales, glass sediment .....do....	5	.....
Magnifying glasses .....do....	17	14
Triangles, wooden .....do....	12	2
Triangles, metallic .....do....	53	12
Reducing squares.....do....	10	.....
Rulers, wooden.....do....	32	31
Rulers, metallic.....do....	36	5
Pentagraphs .....do....	2	1
Ink cups .....do....	35	10
MISCELLANEOUS.		
Globes, astronomical .....number..	2	1
Globes, terrestrial.....do....	1	1
Diamonds, glaziers' .....do....	1	.....
Diamonds, writing.....do....	1	.....
Balance and weights, Becker's.do....	1	1
Tide-gauge paper (40-pound roll), number	1	1
Chronometer crystals .....number..	3	3
Sextant box.....do....	1	1
Field observatory.....do....	1	.....
Lenses.....do....	6	6
Camera, pocket .....do....	1	1
Slides, extra, camera.....do....	2	2
Personal equation apparatus..do....	1	.....
Horseshoe magnets .....do....	3	.....
Tripods, barometer .....do....	14	.....
Total.....	968	297

The instruments turned into depot often require repairs before they are fit for reissue. Many are here in this condition, and it is to be regretted that the usual allowance for the incidental expenses of the depot ($4,000) was reduced to $3,000 by Congress at its last session. The effect will be to compel the purchase of new instruments from the several appropriations for specific works, while suitable instruments lie idle in depot for want of the needful funds for slight repairs.

STATEMENT OF FUNDS.

Congress appropriated the sum of $10,000 for the post and depot during the past year. Of this $5,000 was for the erection of the photographic laboratory, $4,000 for current expenses, and $1,000 for the in-

struction of the Engineer troops in their special duties. The following is a summary statement of these funds:

Expended in fiscal year 1882–'83	$7,280 81
On hand pledged for same	2,719 19
Available for fiscal year 1883–'84	7,000 00
Desired for fiscal year 1884–'85	17,200 00

In explanation of the last item I would submit the following:

I. For the usual annual appropriation for the purchase of materials for the instruction of the three companies of the Battalion of Engineers on duty at Willets Point in their special duties as sappers, miners, and pontoniers, $1,000.

II. For the usual annual appropriation for the incidental expenses of the depot, such as fuel, forage, chemicals, stationery, extra-duty pay for soldiers employed in wheelwright work, engine driving, printing, binding, photographing and lithographing Engineer documents, ordinary repairs of public building, repairs of instruments in depot to fit them for reissue, &c., the needful and usual appropriation for several years has been $4,000; but last year the amount was reduced by $1,000, which will cause an accumulation of instruments awaiting repairs before they can be reissued. For the present appropriation, therefore, the full sum should be appropriated and the deficiency supplied, making the amount requested $5,000.

III. For continuing the construction of the public buildings of the Engineer School of Application. The permission extended to officers of other arms of service to pursue the course of instruction in submarine mining and the increase in rank of the medical officers on duty here have caused the quarters already existing to be insufficient for the needs of the garrison. A new double house, suitable for a major and a captain, and to be specially assigned as medical quarters, is much needed. The legal and necessary allowance of quarters cannot be furnished to the officers now on duty here during six months of the year until this building is erected; and funds are therefore urgently requested. The cost will be $10,000. A small building is also needed as quarters for the sergeant having immediate charge of the torpedo material, who also serves as assistant instructor in this important branch of Engineer duty. He is now quartered with his company at a long distance from the property which he should overlook. The cost will be $1,200, making the total amount needed for continuing the construction of the public buildings $11,200.

Very respectfully, your obedient servant,

HENRY L. ABBOT,
Lieutenant-Colonel of Engineers,
Bvt. Brig. Gen., U. S. A.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

RIVERS AND HARBORS, ETC.

APPENDIX A.

IMPROVEMENT OF RIVERS AND HARBORS IN THE STATES OF MAINE AND NEW HAMPSHIRE.

REPORT OF COLONEL CHARLES E. BLUNT, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1883, *WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

1. Lubec Channel, Maine.
2. Moose-a-bec Bar at Jonesport, Maine.
3. Belfast Harbor, Maine.
4. Rockland Harbor, Maine.
5. Richmond Harbor, Kennebec River, Maine.
6. Cathance River, Maine.
7. "Gut," opposite Bath, Maine.
8. Royal River, Maine.
9. Portland Harbor, Maine.
10. Kennebunk River, Maine.
11. Winnepissiogee Lake, New Hampshire.
12. Lamprey River, New Hampshire.
13. Cocheco River, New Hampshire.
14. Portsmouth Harbor, New Hampshire.

UNITED STATES ENGINEER OFFICE,
Portland, Me., July 9, 1883.

GENERAL: I have the honor to transmit herewith my annual report of operations for the fiscal year ending June 30, 1883, on the several river and harbor improvements and surveys of rivers and harbors under my charge in the States of Maine and New Hampshire.

These works were under the charge of Col. George Thom, Corps of Engineers, until January 16, 1883, on which date I relieved him.

Very respectfully, your obedient servant,

C. E. BLUNT,
Colonel of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

A 1.

IMPROVEMENT OF LUBEC CHANNEL, MAINE.

Lubec Channel forms the eastern boundary of the State of Maine, between the town of Lubec and Campobello Island. For a length of over 2 miles, (*i. e.*, from about 850 feet below the "Western Bar Beacon"

to the head of "Lubec Narrows") it was obstructed by bars having but 5 to 12 feet of water, at mean low water, and for the most part only 5 feet at mean low water or 22 feet at mean high water—the mean rise and fall of the tides being 17 feet; whilst at *extreme* low water at spring tides there was but 1 foot of water over their shoalest parts.

The condition of the channel, therefore, was such that at and near mean low water, vessels were unable to navigate it, and were forced to take a circuitous route, 16 miles longer, from West Quoddy Head to the eastward of Campobello Island, through British waters, in order to reach Lubec, Eastport, Calais, Pembroke, and other ports in Maine, on the Saint Croix and Pembroke rivers. Similar difficulties also occurred to vessels coming down from Calais and other places on the river Saint Croix, which, leaving there at or near high water (as they have to do) reach Lubec Channel in a low stage of the water, either to be detained until a rise of tide or else were forced to take the circuitous route to the eastward of Campobello Island.

With a view to the improvement of this channel, so as to make it navigable in *all* stages of the tide for steamers and other vessels that for the most part would use it, it was surveyed in 1878 with great care and accuracy from deep water, above the head of "the Narrows," to the deep water below the "Western Bar Beacon," a distance of about 2½ miles. On this survey 5,529 soundings were taken and located, and numerous borings made to ascertain the character of the bottom, in which no ledges were encountered or any other material difficult to be excavated by dredging.

The original project for its improvement consisted in excavating it for a width of *not less* than 200 feet, to a depth of 12 feet at mean low water, or 29 feet at ordinary high water, giving a depth of 9 feet at low water of spring tides.

The appropriations for the work have been as follows, viz:

By act of March 3, 1879	$44,000
By act of June 14, 1880	20,000
By act of March 3, 1881	45,000
By act of August 2, 1882	20,000
Total	129,000

Under the appropriations of 1879 and 1880 contract was made with Messrs. Moore & Wright, of Portland, Me., September 2, 1880, for 100,600 cubic yards of dredging, more or less, measured in scows, at an average price of 52½ cents per yard. This dredging, which was done in various parts of the channel, was completed October 2, 1882, the quantity dredged during the past fiscal year having been 42,170 cubic yards on the shoal D–E.

Under the appropriation of 1881 contract was made December 31, 1881, with the same firm, again the lowest bidders, for about 80,000 cubic yards of dredging on the shoal D–E of the official drawings, at 37 cents per cubic yard, measured in scows. Under this contract, which was closed March 31, 1883, 84,016½ cubic yards of material were dredged.

On the 19th of September, 1882, the same firm, again the lowest bidders, contracted for dredging 50,000 cubic yards, more or less, of material, at 32 cents per cubic yard, measured in scows. Work under this contract was commenced on the 2d of April, 1883, and continued till the 30th of June, 1883, during which period 45,831½ cubic yards were dredged, making a total of 172,018 cubic yards during the fiscal year, and the channel of 12 feet mean low-water depth was completed to its *minimum* width of 200 feet as originally projected.

It has, however, been represented to me by parties interested that a still wider and *deeper* channel is desirable. A perfectly straight one is impracticable, but increased width, especially at the bends, would much add to the facility of navigation in the strong tidal currents of the locality. In my opinion the channel through the shoal D–E should be 275 feet wide, with an additional width of 25 feet at the bends above "Western Bar Beacon" and Cranberry Point.

A desire for a mean low-water depth greater than 12 feet has only recently been made known to me. It is stated that propellers drawing fully that have now occasion to pass through, and that a depth of 15 feet at mean low water is what is wanted.

To make this additional improvement in width and depth would require the removal by dredging of—

280,000 cubic yards of material, at 35 cents	$98,000
Contingencies	15,000
Total	113,000

One-third of this sum could be advantageously expended during the latter part of the working season of 1884 and early in 1885, and I therefore respectfully recommend the appropriation of $40,000 at the next session of Congress.

The accompanying letter from the collector of customs at Eastport, besides giving the statistics of arrivals, tonnage, &c., gives some general statements illustrating the value of the improvement of this channel. In addition to this, I submit a letter signed by T. C. Hersey, President International Steamship Company, bearing upon the question of increased width and depth in the channel.

Money statement.

July 1, 1882, amount available		$67,843 15
Amount appropriated by act passed August 2, 1882		20,000 00
		87,843 15
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$66,325 99	
July 1, 1883, outstanding liabilities	6,338 27	
		72,664 26
July 1, 1883, amount available		15,178 89
Amount (estimated) required for completion of existing project		113,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		40,000 00

Abstract of proposals received September 15, 1882, for dredging shoal D–E, 45,000 cubic yards, improvement of Lubec Channel, Maine.

No.	Bidders.	Residence.	Price per cubic yard measured in scows.
1	Moore & Wright	Portland, Me	$0 32
2	George C. Fobes & Co	Baltimore, Md	34

Contract for dredging 50,000 cubic yards, more or less, awarded to Moore & Wright; dated September 19, 1882.

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, EASTPORT, ME.,
Collector's Office, May 17, 1883.

SIR: In reply to your letter of the 12th instant I now submit the following statement:

1. Amount revenue collected year 1882	$82,711 94
2. Exports for same period	430,765 00
3. Imports for same period	852,787 00
4. Number of foreign arrivals	501
Number of foreign clearances	607
Number of vessels built in the district, 2; tonnage	178

The domestic arrivals, except in case of registered vessels, are not reported to the custom-house, and we have no exact record of them, and the same is true of domestic clearances.

The hundreds of vessels that load in this district with the products of the sea, rivers, and forests, will be vastly benefited by the improved channel at Lubec.

The Portland and Boston steamers are now enabled to pass through the channel at an earlier stage of the tide than formerly, and when completed there will be a still greater saving of time to these steamers, as the necessity for going out around Head Harbor and Campobello will not exist to the extent it does at present, while the saving to sailing vessels coming down the rivers emptying into this bay on the ebb tide can hardly be overestimated, the saving under some circumstances amounting to days.

Yours, very respectfully,

W. M. HAYCOCK,
Collector.

Col. C. E. BLUNT,
Corps of Engineers, U. S. A.

LETTER OF PRESIDENT OF INTERNATIONAL STEAMSHIP COMPANY.

INTERNATIONAL STEAMSHIP COMPANY,
Portland, Me., June 27, 1883.

DEAR SIR: We learn the contract for dredging Lubec Narrows, as originally provided for, is about completed.

The commanders and pilots of our steamers report that the channel is not sufficiently wide to make it safe navigation. It should be at least 75 feet wider, and the bends relieved by taking off 50 feet more, particularly off Cranberry Point.

The channel should also be deeper by at least 3 feet for the larger steamers now running on the route to pass through at low water. Steamers of even greater draught of water are likely to go on the route any time.

* * * * * * *

We trust you will favorably report in these matters.

Very truly, yours,

T. C. HERSEY,
President.

Col. CHARLES E. BLUNT,
Corps of Engineers, U. S. A.

A 2.

IMPROVEMENT OF MOOSE-A-BEC BAR AT JONESPORT, MAINE.

Moose-a-bec Bar is at the eastern part of Moose-a-bec Reach, near Jonesport, Me., sand is the only obstruction to the safe navigation of that reach in all stages of the tide. By a survey made in 1879 it was ascertained that this bar had only 5½ feet of water on it at mean low-water, and 3¼ feet in low-water of spring tides, which compelled the coastwise steamers and other vessels of greater draught to take a very tortuous course to the southward among the ledges, as shown on the map accompanying the annual report of 1880. Navigation is thereby

rendered difficult and dangerous, especially at night, and in dense fogs, common on this part of the coast.

The plan adopted for the improvement of this bar consists in opening through it, by dredging, a channel 200 feet in width and 14 feet in depth at mean low-water (or 11¾ feet at low-water of spring tides) for an average length of about 1,900 feet. The mean rise and fall of the tides is 11.53 feet. Near the western end of this projected channel to the southwest of "Steamboat Buoy" is a sunken ledge which has only 10¾ feet of water on it at mean low-water, but with 18 feet all around it; which ledge, it is projected to remove to a depth of 15 feet at mean low-water.

The estimated cost of this improvement (as amended) is as follows, viz:

85,000 cubic yards of dredging (measured in scows), at 35 cents per cubic yard	$29,750
Removal of 136½ cubic yards of sunken ledge, at $40 per cubic yard, *in situ*	5,460
Adding for engineering expenses and contingencies	4,790
Total	40,000

The following appropriations have been made by Congress for this work, viz:

By the river and harbor act of March 3, 1881	$10,000
By the river and harbor act of August 2, 1882	10,000
Total	20,000

Under the first appropriation the new channel was opened to a width of 85 feet. Under the second it is expected to add 65 feet to the width. A contract has been made, under which no work has yet been done, but it is hoped it will be executed this season.

This is a frequented channel, and it is very desirable that it should be completed as soon as possible.

Jonesport Me., is an outport in the collection district of Machias, Me., and the nearest light-house is Moose-a-bec light.

Money statement.

July 1, 1882, amount available		$514 28
Amount appropriated by act passed August 2, 1882		10,000 00
		10,514 28
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$132 03	
July 1, 1883, outstanding liabilities	58 00	
		190 03
July 1, 1883, amount available		10,324 25
Amount (estimated) required for completion of existing project		20,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		20,000 00

Abstract of proposals received September 15, 1882, *for dredging* 27,000 *cubic yards at Moose-a-bec Bar at Jonesport, Me.*

No.	Bidders.	Residence.	Price per cubic yard measured in scows.
1	Geo. C. Fobes & Co	Baltimore, Md.	$0 44
2	Moore & Wright	Portland, Me	54

Both rejected, being deemed too high.

Abstract of proposals received November 7, 1882, for dredging 25,000 cubic yards at Moose-a-bec Bar at Jonesport, Me.

No.	Bidders.	Residence.	Price per cubic yard measured in scows.
1	Moore & Wright	Portland, Me	$0 42
2	Robert Hamilton, jr	Cumberland, Me	47½

Contract for dredging 22,000 cubic yards, more or less, awarded to Messrs. Moore & Wright; date of contract November 20, 1882, dredging to be commenced August 1, 1883, and completed on or before October 31, 1883.

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, MACHIAS, ME.,
Collector's Office, May 22, 1883.

SIR: I have the honor to acknowledge the receipt of your communication of the 12th instant, relating to the improvements contemplated at Moose-a-bec Bar, Jonesport, Me., and in reply thereto you are informed:

1. The amount collected at the custom-house at Jonesport during the year ending December 31, 1882, was $823.79.

2. Exports and imports during that period, none.

3. The number of arrivals and departures of vessels (foreign and domestic) during that time cannot be stated accurately, as most of the vessels are sailing under coasting papers, and are not required to report at the custom-house every trip.

During the time specified there were 67 entrances and clearances foreign, and 7 ditto coastwise by registered vessels. Fourteen vessels, measuring 2,641.08 tons, were built in this district during that year.

4. A large amount of commerce and navigation will be benefited by the contemplated improvements. Mr. J. M. Johnson, the customs officer stationed at Jonesport, estimates the number of vessels annually passing through Moose-a-bec Reach to be at least 2,500.

The steamers of the International line plying between Boston and Saint John, N. B., via Portland and Eastport, frequently make use of this passage in rough weather when the tide serves, and would do so oftener if the obstructions were removed so as to make it safe at all times of tide.

The removal of these obstructions would also be a great convenience to the boats of the Portland and Machias line, as they are often obliged to wait at Jonesport for the tide to rise before venturing over the bar.

I am, sir, very respectfully,

J. L. PIERCE,
Collector.

Col. C. E. BLUNT,
Corps of Engineers.

A 3.

IMPROVEMENT OF BELFAST HARBOR, MAINE.

The following appropriations have been made by Congress for the improvement of this harbor, to wit:

By the river and harbor act of August 14, 1876	$5,000
By the river and harbor act of June 18, 1878	12,000
By the river and harbor act of March 3, 1879	5,000
By the river and harbor act of June 14, 1880	3,000
Total	25,000

The work projected for the improvement of this harbor under the above-named appropriations consisted of the removal of the sunken ledges and shoals in front of the wharves, from Lane's Wharf down to McGilvery's ship-yard, so as to have a depth of not less than 10 feet at mean low water (or 19¾ feet at mean high water), down to the Boston Steamer Wharf, and thence down to McGilvery's Wharf, a depth of 11 to 12 feet at mean low water. This work was commenced in August, 1877, and completed in September, 1879, leaving unexpended the appropriation of $3,000 made by the river and harbor act of June 14, 1880.

Belfast Harbor is the only port of entry in the district of Belfast, Me. The nearest light-houses are those on Dice's Head, near Castine, and on Fort Point, both about 10 miles from Belfast; and the nearest fort is Fort Knox, opposite Bucksport, about 18 miles from Belfast.

The following information in regard to the revenue and commerce of the district of Belfast for the year ending December 31, 1882, has been furnished by the United States collector of customs at that port, viz:

Amount of revenue collected	$3,294 86
Amount of imports	7,952 60
Amount of exports	7,199 00
Number of arrivals, foreign	46
Number of clearances, foreign	47

Vessels built, 16, with aggregate tonnage of 6,515.80 tons.

Money statement.

July 1, 1882, amount available	$3,000 00
July 1, 1883, amount available	3,000 00

A 4.

IMPROVEMENT OF ROCKLAND HARBOR, MAINE.

Two appropriations have been made for this harbor, viz, June 14, 1880, $20,000, and August 2, 1882, $40,000.

The project that has been adopted for this improvement consists in the construction of two breakwaters to a height of 5 feet above mean low water, with a width on top of 10 feet, one commencing at Jameson Point and extending in a direction about S. 16½° E. for a distance of 1,900 feet; and the other commencing at South Ledge and extending in a direction about N. 9° E. towards Jameson Point for a distance of 2,640 feet, as shown on the sketch accompanying the Annual Report of 1881.

The estimated cost of these breakwaters (as revised) is as follows, viz:

1. For breakwater D—E, at Jameson Point, 135,000 tons of rubble-stone, at 90 cents per ton	$121,500
2. For breakwater A—C (extending from South Ledge towards Jameson Point), 420,000 tons of rubble-stone, at 90 cents per ton	378,000
Adding for engineering expenses and other contingencies, say	50,500
Total	550,000

The Jameson Point Breakwater, which it has been decided should be taken in hand first, was at the beginning of the fiscal year built to a point about 783 feet from high-water mark.

On the 4th of October, 1882, contract was made with Mr. John F.

Hamilton, of Portland, Me., for the extension of this breakwater by furnishing and placing 30,000 tons, more or less, of granite quarry grout, at $1.17 per ton of 2,240 pounds. Work under this contract was commenced on the 9th of October, 1882, and suspended for the winter on the 21st of December, during which period 14,294 tons of stone were placed in the breakwater. Operations were resumed on the 9th of April, 1883, between which date and the 26th of June, when work under the contract was satisfactorily completed, 30,232 tons of stone were delivered and placed, making a total of 30,232 tons during the fiscal year, by which 326 feet have been added to the length of the breakwater, carrying it to a point 1,109 feet beyond high-water line.

Rockland is a port of entry in the collection district of Waldoborough, Me., and the nearest light-house is at Owl's Head, about 2 miles distant.

The accompanying letter of the United States deputy collector of customs at Rockland furnishes the required information in regard to the revenue and commerce of that port for the year ending December 31, 1882.

Money statement.

July 1, 1882, amount available	$127 20
Amount appropriated by act passed August 2, 1882	40,000 00
	40,127 20
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	36,665 63
July 1, 1883, amount available	3,461 57
Amount (estimated) required for completion of existing project	490,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	75,000 00

Abstract of proposals received September 15, 1882, for furnishing 50,000 tons, more or less, of granite quarry grout for projected breakwater at Jameson Point, Rockland Harbor, Maine.

No.	Bidders.	Residence.	Price per ton of 2,240 pounds.
1	John F. Hamilton, agent	Portland, Me.	*$1 17
2	William S. White	Rockland, Me.	1 20
3	Bodwell Granite Company	do	1 25
4	Mount Waldo Granite Works	Frankfort, Me.	1 87

Contract for furnishing and placing 30,000 tons, more or less, awarded to John F. Hamilton, agent; contract dated October 4, 1882.

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, DISTRICT OF WALDOBOROUGH, ME.,
Deputy Collector's Office, Rockland, June 11, 1883.

DEAR SIR: * * * * * *

I give below, as far as I am able, the information you require, viz:

Revenue collected	$4,500
Value of imports	68,000
Entries of foreign and American vessels from foreign ports	248
Clearances of foreign and American vessels to foreign ports	258

As to the coastwise movement of tonnage, I can only reiterate my former statements to General Thom, increased some by an increase of business and an increase of the number of vessels owned and documented at this port.

There were built during the year 6 vessels, of an aggregate tonnage of 2,083 tons.

I have been informed by masters of vessels that during the year they availed themselves of that portion of the breakwater already under construction, and that a large number of stranger vessels are doing the same. As the work advances the more important it becomes, and the more vessels take advantage of the security it offers rather than run the risk of disaster in seeking a safer harbor farther along, and I have no hesitancy in saying that before the work is completed Rockland Harbor will become a harbor of refuge, which it is well calculated to be when properly protected, it lying, as it does, at the mouth of all the outlets from the eastern waters.

I remain, sir, very respectfully,

J. W. CROCKER,
Deputy Collector of Customs.

Col. C. E. BLUNT,
United States Engineer.

A 5.

IMPROVEMENT OF RICHMOND HARBOR, KENNEBEC RIVER, MAINE.

By the river and harbor act of June 14, 1880, provision was made for a survey of this harbor, in Kennebec River, Maine, with a view to its improvement. This survey was made in November, and on the 10th of December, 1880, a report on the same was submitted to the Department with a project and estimate for its improvement.

Kennebec River is here divided by Swan Island into two channels, of which the main channel passes to the eastward of the island through "the Narrows," with a navigable depth of 10 to 11 feet at mean low water, while the western channel, which forms Richmond Harbor, so called, is navigable for the same depth except at the following places, viz:

1. At the head of Swan Island.
2. At Hatch's Rocks Shoal, about 2 miles below head of island.
3. At the foot of Swan Island, about 5 miles below its head.

The shoal at the head of Swan Island was improved in 1872 by dredging to a depth of 10 feet at mean low water (or 15 feet at ordinary high water), but, as was then predicted, it has been reproduced by the same causes as before. For insuring the continuance of its depth, if again dredged, it was recommended that a wing-dam be built out from the upper end of Swan Island, as shown on the sketch accompanying report on the survey, in order to create a greater scour *on the bar*, by the diversion into its channel of a part of the water of the main channel of the river.

At Hatch's Rocks Shoal it was proposed to dredge a straight channel through it to a depth of 10 feet at mean low water for a width of 100 feet.

At the lower end of this harbor, near the foot of Swan Island, icehouses have been built and projected to such an extent as to warrant an improvement of the channel at that place by widening and deepening the same. In this locality it was proposed to make the channel not less than 11 feet in depth at mean low water, or about 16 feet at ordinary high water, to enable sea-going vessels of a larger class to engage in the transportation of ice, as this depth can be carried through to the ocean.

The estimated cost of the improvement above projected, as revised, was as follows, viz:

1. Shoal at the head of Swan Island, 3,600 cubic yards of dredging, at 30 cents per cubic yard	$1,080
2. Hatch's Rocks Shoal, 30,000 cubic yards of dredging, at 33 cents per cubic yard	9,900

3. Shoal at the foot of Swan Island, 12,000 cubic yards of dredging, at 29 cents per cubic yard	$3,480
4. Wing-dam at the head of Swan Island, 3,500 tons of rubble stone, at $1 per ton of 2,240 pounds	3,500
Adding for engineering expenses and other contingencies	2,040
Total	$20,000

Appropriations were made of $10,000 March 3, 1881, and $10,000 August 2, 1882, and the project has been completed.

The work done during the fiscal year ending June 30, 1883, has been as follows:

Under contract with Mr. Sam F. Purington, of Brunswick, Me., made June 30, 1881, the work in progress at the date of the last annual report was completed September 20, 1882, he having dredged during the year 7,083 cubic yards at the foot of Swan Island and 8,972 cubic yards at Hatch's Rocks.

On the 20th of September, 1882, contract was made with the Kennebec Dredging Company, of Hallowell, Me., for the dredging required at the head of Swan Island and at Hatch's Rocks, at 40 cents per cubic yard, measured *in situ*. Work under this contract was commenced on the 21st of September, 1882, and suspended for the winter November 28, 1882, during which period 14,381 cubic yards were dredged. Work was resumed on the 10th of May and completed the 9th of June, 1883, during which period 8,541 cubic yards were dredged, making a total of 22,922 cubic yards under this contract, and of 38,977 cubic yards under both contracts during the fiscal year, thus completing all the work projected for the improvement of this harbor.

Richmond Harbor is situated in the collection district of Bath, of which Bath is the port of entry, and is about 10 miles above Bath, on the Kennebec River. The nearest light-houses are Seguin and Pond Island, near the mouth of Kennebec River, and the nearest fort is Fort Popham, at the mouth of Kennebec River, distant about 25 miles below Richmond.

Money statement.

July 1, 1882, amount available	$6,531 03	
Amount appropriated by act passed August 2, 1882	10,000 00	
		16,531 03
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		16,531 03

Abstract of proposals received September 15, 1882, for about 30,000 cubic yards of dredging at Hatch's Rocks Shoals, and about 3,500 cubic yards at the head of Swan Island, in Kennebec River, at and near Richmond, Me.

No.	Bidders.	Residence.	Dredging.	
			Measured *in situ*.	Measured in scows.
			Per cu. yd.	*Per cu. yd.*
1	Kennebec Dredging Company, by C. W. Tilden, treasurer.	Hallowell, Me	$0 40	$0 34
2	Augustus R. Wright	Portland, Me	60	40

Contract for dredging 23,000 cubic yards, more or less, awarded Kennebec Dredging Company at 40 cents per cubic yard measured *in situ;* contract dated September 20, 1882.

A 6.

IMPROVEMENT OF CATHANCE RIVER, MAINE.

The following appropriations have been made by Congress for the improvement of this river, viz:

By the river and harbor act of June 14, 1880	$10,000
By the river and harbor act of March 3, 1881	6,000
By the river and harbor act of August 2, 1882	5,000
Total	21,000

The head of navigation of this river is at the bridge at Bowdoinham, Me., from which to its outlet into Merrymeeting Bay (a distance of about 2⅝ miles) the river has a navigable channel of not less than 19 feet depth at mean low water, or 24½ feet at mean high water. From its outlet into the bay the channel continues in an indirect course, with depths varying from 26 to 6 feet at mean low water for a distance of about 2⅛ miles to its junction with the main channel of Kennebec River, near "The Chops." The principal obstruction to its navigation was found by the special survey of 1879 to be at "the outer bar," where the channel enters the Kennebec River, on the shoalest part of which there was but 6 feet of water at mean low water, or 11½ feet at mean high water. But owing to the shifting character of this bar, it was not believed that any work, unless attended by a cost too great to be warranted by the object of the improvement, would effect a permanent improvement of the channel at this place. At the other two shoals, lying between "the outer bar" and the outlet of the river into the bay, it was believed that the channel could be widened and deepened in a more effectual and satisfactory manner. A channel with a depth of 10 feet at mean low water (or 15½ feet at mean high water) for a width of not less than 200 feet, was projected for the improvement of this river, at an estimated cost of $25,000.

The appropriations of 1880 and 1881 were expended on "the outer bar" and on Bar III, as specified in the Annual Report for 1882.

On the 7th of November, 1882, proposals were opened for widening and deepening the channel at Shoal No. 4, so as to have a depth of 10 feet at mean low water, or about 15½ feet at mean high water. Contract was made November 13, 1882, with the lowest bidders, the Kennebec Dredging Company, of Hallowell, Me., for 13,000 cubic yards, more or less, of dredging, at 34 cents per yard, measured in scows. Work was commenced on the 8th of June, between which date and the 30th, 9,450 cubic yards of material were removed. The completion of work under this contract, which will probably be reached by the 10th of July, 1883, will complete this improvement as proposed, and no additional funds are asked for.

As no information has been obtained, in addition to that given last year, as to the "extent to which the commerce and navigation of the country" would be benefited by this improvement, the statement of residents of Bowdoinham, furnished through the collector of customs at Bath, is here repeated, viz:

> The people interested are the towns of Bowdoinham and Bowdoin, to enable them to ship their cargoes in vessels of large size and deeper draught of water. The cargoes *outward*, now shipped in schooners and scows, are chiefly spruce lumber, deals, frame stuff, &c., say 2,500,000 feet, which would be doubled if we could load a ship here, say 1,000 tons ground feldspar rock, 500 tons quartz rock, 100,000 bricks, hay, wood, and bark; *inward*, say 1,000 tons of anthracite coal, 500 tons plaster, rock, &c. Since 1850, twenty vessels, having an aggregate of 17,000 tons, have been built on the banks of Cathance River.

It was also stated that a large quantity of ice is cut and stored on this river for shipment; that in 1863 about 50,000 tons were cut and stored, but not all shipped, as vessels of sufficient size could not pass the bar.

Money statement.

July 1, 1882, amount available		$58 67
Amount appropriated by act passed August 2, 1882		5,000 00
		5,058 67
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$2,723 85	
July 1, 1883, outstanding liabilities	689 52	
		3,413 37
July 1, 1883, amount available		1,645 30

Abstract of proposals received September 15, 1882, for 20,000 cubic yards dredging for improvement of Cathance River, Maine.

No.	Bidders.	Residence.	Price per cubic yard measured in scows.
1	Kennebec Dredging Company	Hallowell, Me	$0 39
2	Moore & Wright	Portland, Me	42

Rejected; being deemed unreasonably high.

Abstract of proposals received November 7, 1882, for 13,000 cubic yards dredging for improvement of Cathance River, Maine.

No.	Bidders.	Residence.	Price per cubic yard measured in scows.
1	Kennebec Dredging Company, by C. W. Tilden, treasurer.	Hallowell, Me	$0 34

Contract awarded to the Kennebec Dredging Company; date of contract November 13, 1882.

A 7.

IMPROVEMENT OF THE "GUT" OPPOSITE BATH, MAINE.

The "Gut" is a part of Back River, which is a tidal river about 9 miles in length, connecting the Kennebec River at Bath, Me., with the tide waters of Sheepscot River to the eastward of it. It is navigable for small steamers and other vessels of light draught, and affords a short communication between Kennebec River and the towns of Westport, Wiscasset, Boothbay, Southport, and other places on or near the waters of the Sheepscot. At the "Gut" (or more commonly called "Upper Hell Gate"), which is about 2 miles distant from the city of Bath, the navigation of Back River was very much improved in its difficult places under appropriations made therefor by Congress in 1870

and 1871, amounting to $16,500, as stated in the Annual Report of 1873; and for its further improvement the following appropriations have since been made by Congress, viz:

By the river and harbor act of June 18, 1878	$17,000
By the river and harbor act of June 14, 1880	7,000
By the river and harbor act of March 3, 1881	5,000
Total	29,000

These appropriations have been made with a view to opening a navigable channel with a depth of not less than 11 feet at mean low water above "The Narrows" and 12 feet below "The Narrows," for a width not less than 90 feet, by the breaking up and removal of the several sunken ledges and shoals by which the channel has hitherto been obstructed.

On referring to the last Annual Report it will be seen that all the projected improvements had then been completed except the breaking up and removal of about 57 cubic yards of Ledge E, near the head of "The Narrows." This was done by Mr. George W. Townsend, under his contract of June 16, 1881, the work having been finished on the 13th of September, 1882, thus completing the improvements projected at this point.

This locality lies in the collection district of Bath, Me., of which Bath is the port of entry, and is distant about 2 miles from Bath. The nearest light-houses are Pond Island and Seguin lights near the mouth of Kennebec River, and the nearest fort is Fort Popham, at the mouth of that river and distant about 15 miles.

The following information in regard to the revenue and commerce of the district of Bath for the year ending December 31, 1882, has been furnished by the United States collector of customs at that port:

Gross customs receipts	$100,500 23
Rebated for the construction and repair of vessels, not included in above.	49,566 29
Number of vessels arrived, about	2,300
Number of vessels departed, about	2,365

Number of vessels built, 65; 42,870.01 tons.
About 1,200,000 tons of ice shipped.
About 18,000,000 feet of lumber shipped.

Money statement.

July 1, 1882, amount available	$2,981 75
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	2,981 75

A 8.

IMPROVEMENT OF ROYAL RIVER, MAINE.

Royal River, or properly Yarmouth River (the name Royal being applied above the head of navigation at Yarmouth), was obstructed by a land-slide which occurred on the 30th of March, 1882, nearly blocking the channel opposite Wolfe's Point.

A general examination of the locality was made in April, 1882, and an estimate of $10,000, as the probable cost of remedying the difficulty, was made. Appropriation of that sum was made by the act of August 2, 1882.

A special survey was made in August, 1882, upon which a project was based and submitted to the Department on the 14th of September.

As an examination of the river bank in the vicinity of the slide showed that other accidents of the same nature were liable to occur there, it was deemed advisable not to remove the fallen material, but to place a wing-dam of rubble-stone just above it, with the double object of diverting the current from the south bank and into a new channel close to Wolfe's Point, to be obtained by dredging. Approval of this project was not received until February, 1883. Proposals for the construction of the wing-dam were opened March 19, 1883, and contract made March 27 with Mr. Silas F. Hamilton, of Chebeague Island, Maine (the lowest of six bidders), for 4,700 tons of rubble-stone (in the work), at 71 cents per ton.

Mr. Hamilton began the work on the 5th of May, as soon as the river was completely free from ice, and up to June 30 had delivered 2,277 tons of stone. It is hoped that he will complete the wing-dam early in the fall.

On the 21st of June, proposals for the dredging required for the new channel were opened, but the two bids received were both much too high, and were rejected. Proposals will be again invited, and it is hoped that a satisfactory contract can be made for completing the whole work before the closing of the river by ice.

The whole improvement is thus expected to be finished this year, and no further appropriation is required.

No special statistics applicable to Yarmouth have been obtained. It is known, however, that ship-building is carried on there to a considerable extent, and access to the sea is an absolute necessity.

Money statement.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$1,594 23	
July 1, 1883, outstanding liabilities	324 80	
		1,919 03
July 1, 1883, amount available		8,080 97

Abstract of proposals received March 19, 1883, for furnishing and placing 4,700 tons rubble-stone for the construction of a wing-dam for improvement of Royal River, Maine.

No.	Bidders.	Residence.	Price per ton of 2,240 pounds.
1	Silas F. Hamilton	Chebeague Island, Maine	$0 71
2	Richard Harding and Oliver Jordan	Yarmouth, Me	89
3	Hugh Bowen and Joseph F. Curit	Chebeague Island, Maine	1 17
4	Simeon Hamilton and Albion S. Hamilton	Deering, Me / Cape Elizabeth Depot, Maine	1 26
5	John F. Hamilton	Portland, Me	1 27
6	Hiram B. Cobb	Brunswick, Me	1 70

Contract awarded to Silas F. Hamilton; dated March 27, 1883.

Abstract of proposals received June 21, 1883, for dredging opposite Wolfe's Point for improvement of Royal River, Maine.

No.	Bidders.	Residence.	About 16,000 cubic yards, measured *in situ*.	
			Measured *in situ*.	Measured in scows.
			Per cu. yd.	*Per cu. yd.*
1	Augustus R. Wright	Portland, Me	$0 41	$0 26
2	Kennebec Dredging Company, by C. W. Tilden, treasurer.	Hallowell, Me	44	28

Both bids rejected, being deemed too high.

A 9.

IMPROVEMENT OF PORTLAND HARBOR, MAINE.

Operations having been suspended in this harbor early in February, 1882, owing to the exhaustion of the funds, could not be renewed until a new appropriation should become available.

The act of August 2, 1882, appropriated $35,000 for this harbor. On the 31st of that month proposals were invited for 200,000 cubic yards, more or less, of dredging upon the "Middle Ground," in the lower part of the harbor, and contract made on the 19th of September, 1882, with Messrs. Moore & Wright, of Portland, Me., the lowest of three bidders, for 250,000 cubic yards, more or less, of dredging, measured in scows, at $13\frac{3}{8}$ cents per cubic yard. Work was not begun under this contract until the 8th of January, 1883. Extreme cold weather compelled its suspension on the 23d of January, and it was not resumed until the 6th of March, between which date and the 30th of June it has been steadily prosecuted, resulting in the removal up to the latter date of 170,347 cubic yards of material, and adding 350 feet to the main channel.

The work will continue until the completion of the contract on the 31st of August, when the funds will also be substantially exhausted, and operations will be suspended until a new appropriation shall be available.

To complete the removal of the "Middle Ground" there is still required the additional sum of $75,000.

All the works completed and projected for the improvement of this harbor are in the collection district of Portland and Falmouth, Me., and the nearest forts are Gorges, Scammel, and Preble, and the battery on Portland Head; the nearest lighthouses are, one at the extremity of the breakwater and one at Portland Head.

The following information in regard to the revenue and commerce of this port for the year ending December 31, 1882, has been furnished by the United States collector of customs, viz:

Amount of revenue collected	$831,876 67
Value of exportations	11,331,850 00
Value of importations	11,135,235 00
Duties assessed	3,927,761 69

	Number.	Tonnage.	Crew.
American vessels arrived from foreign ports	104	50,502	1,040
Foreign vessels arrived from foreign ports	278	155,722	3,483
American vessels cleared for foreign ports	255	121,930	2,548
Foreign vessels cleared for foreign ports	283	161,923	3,692
Arrivals coastwise	476	414,251	7,215
Clearances coastwise	374	302,489	6,582
Vessels built within the district	14	5,450	

Money statement.

July 1, 1882, amount avialable		$1,181 46
Amount appropriated by act passed August 2, 1882		35,000 00
		36,181 46
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$20,336 28	
July 1, 1883, outstanding liabilities	5,150 80	
		25,487 08
July 1, 1883, amount available		10,694 38
Amount (estimated) required for completion of existing project		75,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		75,000 00

Abstract of proposals received September 15, 1882, *for dredging* 200,000 *cubic yards at the "Middle Ground," for the improvement of Portland Harbor, Maine.*

No.	Bidders.	Residence.	Price per cubic yard measured in scows.
			Cents.
1	Moore & Wright	Portland, Me	13⅜
2	Geo. C. Fobes & Co	Baltimore, Md	14 3/10
3	Robert Hamilton, jr., and Solomon Sawyer	Cumberland, Me / Yarmouth, Me	16½

Contract, dated September 19, 1882, awarded Messrs. Moore & Wright for dredging 250,000 cubic yards to make 21 feet at mean low water.

A 10.

IMPROVEMENT OF KENNEBUNK RIVER, MAINE.

The project originally adopted for the improvement of this river consisted in the erection in 1829–'52 of two granite piers at its mouth, to afford a permanent entrance to the river and of a wharf a short distance above, for the security of vessels when detained by tides and storms. With the appropriations made in 1870 and 1871, aggregating $10,000, these piers were extended and repaired, and the wharf above was also repaired. This project was modified in 1876, the object being to afford a channel of navigable width from the mouth of the river up to Kennebunkport, a distance of about 1 mile, and of not less than 4 feet in depth at mean low water, or 13 feet at mean high water.

The amount expended from 1870 to June 30, 1882, is $19,971.25, and has resulted, in addition to the extension and repairs of the piers and wharf, in the completed improvement of the channel as projected.

No repairs have been made during the past year.

The amount now available is to be applied to such repairs of the wharf and piers as hereafter may be found necessary.

This river lies in the collection district of Kennebunk, of which Kennebunk is the port of entry.

The following information has been furnished by the United States deputy collector of customs of Kennebunk in regard to the revenue and commerce of that port for the year ending December 31, 1882, viz:

No revenue collected and no exports or imports. Vessels built, 10, with an aggregate tonnage of 816.74, the largest of which measured 162.91 tons.

Money statement.

July 1, 1882, amount available	$1,028 85
July 1, 18-3, amount available	1,028 85

A II.

IMPROVEMENT OF WINNEPISSIOGEE LAKE, NEW HAMPSHIRE.

Winnepissiogee Lake and its tributaries lie wholly within the State of New Hampshire, their waters forming the chief source of Merrimac River.

The lake is about 20 miles in length, and has an average width of about 5 miles. At its southwestern extremity (at Weirs) it has an outlet into Long Bay, which bay is navigable for a distance of 4 miles to its outlet at Lake Village. A dam built at Lake Village forms a reservoir of these waters, which is under the control of an incorporated company, by which water power is regulated and supplied to factories along the Merrimac River below.

These waters are navigated, when not closed by ice, by three or four steamers, drawing from 4 to 5 feet of water, and by seven or eight smaller ones of 1 to 3 feet draught. The largest three of these steamers run in connection with the railroads, which strike the lake at Alton Bay and Wolfborough, at its eastern extremity, and at Weirs at its southwestern extremity, as well as to Center Harbor at its northwestern extremity; also through Long Bay to Lake Village. They are chiefly intended and used from the middle of May to the latter part of November for the transportation of pleasure travel, whilst the smaller boats are used principally for carrying wood and produce and occasionally passengers about the shores of the lake.

The project adopted for the improvement of this lake consists in widening and deepening the shoal at its outlet into Long Bay, so as to enable steamers to pass through this outlet in all stages of the water, it being the only obstacle to extending navigation to Lake Village. The shoalest water found in this shoal at the time of the survey (in the latter part of August, 1879), when the water was 8½ inches below the top of the dam at Lake Village, was 4.5 feet.

From information obtained at the office of the Winnepissiogee Lake Cotton and Woolen Manufacturing Company, at Lake Village, it appeared that the *lowest* water known in the lake stood at 48 inches below the top of the dam at that place, whilst the *highest* water known was 18 inches above the top of that dam. From this it is seen that the depths found by the survey were 39½ inches (or 3.3 feet) greater than would have obtained in the lowest known stages of the water, and 26½ inches (or 2.2 feet) lower than in its highest stages.

The depth of water required for such steamers as would be likely to navigate Long Bay in running to Lake Village, as stated by parties interested therein, would be about 5 feet, to obtain which depth in the

lowest stages of the water would call for a depth of 8.3 feet as measured in the stage which it had in August, 1879, when the survey was made.

The estimated cost of the dredging required for this improvement was $7,500, for which the following appropriations have been made by Congress, viz:

By the river and harbor act of June 14, 1880	$5,000
By the river and harbor act of March 3, 1881	2,500
Total	7,500

Under these appropriations contracts were made November 16, 1880, and June 17, 1881, with the Winnepissiogee Lake Cotton and Woolen Manufacturing Company for 7,250 cubic yards of dredging, at $1 per cubic yard. This dredging was completed under the last contract on the 23d of August, 1882, 1,285 cubic yards having been dredged during the fiscal year ending June 30, 1883.

The original project has been completed and no additional funds are asked for.

Money statement.

July 1, 1882, amount available	$3,266 05
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,266 05

A 12.

IMPROVEMENT OF LAMPREY RIVER, BELOW NEW MARKET, NEW HAMPSHIRE.

This river empties into Great Bay at a point about 10 miles distant by water from Portsmouth, N. H. From a survey made in 1874, and again in 1881, it was found that this river was navigable at high water from its mouth up to New Market wharves, at the head of tide water, a distance of about 2½ miles, the mean rise and fall of the tides being about 7 feet at its mouth and about 6½ feet at New Market. From its mouth up to the head of the Lower Narrows (a distance of 1¾ miles) the channel had a navigable depth of 12 feet at mean high water, but was obstructed in several places by a large number of sunken bowlders, which made navigation difficult and dangerous; and above the Lower Narrows it had a navigable depth of not more than 9½ feet at mean high water in its shoalest places, and was obstructed in several places by numerous bowlders, ledges, and shoals, whilst in front of the wharves at New Market there was a shoal on which the depth varied from 4 to 10 feet at mean high water.

The project proposed for the improvement of this river consisted in making a safe and unobstructed channel, not less than 40 feet in width, and to have a depth of not less than 11½ feet at mean high water up to the lower wharf in New Market, and thence a depth of 11 feet up to the upper wharves of that place.

Two appropriations have been made for this improvement, viz:

By act of March 3, 1881	$10,000
By act of August 2, 1882	10,000
Total	20,000

Under the first appropriation operations were commenced early in July, 1881, for the removal of the sunken bowlders from the channel. This work was done by a submarine party and hired labor, and with implements and machinery purchased in open market, and was continued up to the end of October, 1881, resulting in the removal of more than 2,000 tons of sunken bowlders, whereby the navigation of this river was very much improved both in depth and safety.

The balance available on the 1st of July, 1882, and the appropriation of $10,000 of August 2, 1882, have been expended during the past fiscal year as follows:

A dredge with the necessary auxiliaries, hired by the day at $100 per day (the nature of the work precluding contract), removed scattered sunken rocks, hard pan, &c., from the channel between the head of the Lower Narrows and the lower wharves of New Market to the estimated amount of 2,850 cubic yards between July 1 and August 18, 1882. A submarine party employed by the day up to the same date, removed about 375 cubic yards of ledge and 300 tons of bowlders. The funds being practically exhausted (the appropriation of August 2, 1882, not yet being available), operations were then temporarily suspended. On the 22d of November, 1882, contract was made with Mr. Thomas Symonds, of Leominster, Mass. (the lowest bidder), for completing the channel in front of the New Market wharves by the removal of about 13,000 cubic yards of material (sand, mud, gravel, and some bowlders) at the rate of 65 cents per cubic yard measured *in situ*. Work under this contract was immediately commenced, but suspended for the winter on the 9th of December, 1882. On the 27th of March, 1883, work was resumed by the contractor, who completed everything called for in his contract on the 14th of May, removing in all 12,956 cubic yards of material.

When, on the 18th of August, 1882, the dredge hired by the day for the removal of bowlders, &c., stopped operations for want of funds, there remained still a few days' work of this kind to be done. This dredge resumed operations (on the same terms) on the 15th of May, 1883, and between that date and the 21st of May removed about 330 cubic yards of bowlders, &c.

On the 21st of May, 1883, active operations in connection with this improvement were closed. The only part of the original project remaining unexecuted is the widening and deepening of the channel at the sharp bend on the "Point of Flats" in Great Bay. For this my predecessor asked an additional appropriation of $4,000, which would complete the improvement as projected, and I renew his recommendation. At the same time, while having no reason to reduce the estimate of the cost of the alternative "straight cut" mentioned in the original project of 1874, I am disposed to believe that it would make an entrance to the river much more convenient and satisfactory to those interested.

In the last annual report for this improvement the extent to which the "commerce of the country" would be benefited by the improvements at Lamprey River is illustrated by statements of "credible informants" made in 1874; (see Annual Report of Chief of Engineers, 1875, vol. 2, page 424). Assuming the correctness of these statements, I am not able to add anything thereto, although, so far as my own information goes, the factories at New Market are the immediate and principal gainers by the improvement, in the increased facilities for their coal supply.

Lamprey River lies within the collection district of Portsmouth, N. H., of which Portsmouth is the port of entry, and the nearest light-houses and forts are at and near the entrance of that harbor.

Money statement.

July 1, 1882, amount available	$5,674 75
Amount appropriated by act passed August 2, 1882	10,000 00
	15,674 75
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	15,366 33
July 1, 1883, amount available	308 42
Amount (estimated) required for completion of existing project	4,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	4,000 00

Abstract of proposals received September 15, 1883, for dredging 20,000 cubic yards in Lamprey River, New Hampshire.

No.	Bidders.	Residence.	Price per cubic yard.	
			Measured *in situ.*	Measured in scow.
1	Geo. Q. Dow	Epping, N. H	$0 79	$ 74
2	Thomas Symonds	Everett, Mass	85	60
3	Augustus R. Wright	Portland, Me	80	55

All rejected, being deemed too high.

Abstract of proposals received November 7, 1883, for dredging 13,000 cubic yards in Lamprey River, New Hampshire.

No.	Bidders.	Residence.	Price per cubic yard.	
			Measured *in situ.*	Measured in scow.
1	Thomas Symonds	Leominster, Mass	$0 65	.....
2	Augustus R. Wright	Portland, Me	68	.....
3	Geo. Q. Dow	North Epping, N. H	68	$0 59

Abstract of contracts made during the fiscal year ending June 30, 1883, for the improvement of Lamprey River, New Hampshire.

Date of contract.	Contractor.	Nature of work.	Price.
1882. Nov. 22	Thomas Symonds, of Leominster, Mass.	Widening and deepening the channel in front of the wharves at New Market, N. H.	65 cents per cubic yard, measured *in situ.*

A 13.

IMPROVEMENT OF COCHECO RIVER, NEW HAMPSHIRE.

Cocheco River runs through the city of Dover, N. H., and 3 miles below the lowest bridge it unites with the Salmon Falls River and forms the Piscataqua River, from which point down to its outlet into Portsmouth Harbor, New Hampshire, a distance of about 9 miles, the Piscataqua River separates the States of Maine and New Hampshire.

The Piscataqua and Cocheco rivers are navigable, in the lowest summer stages, with not less than 6 feet of water at mean low water, or

about 13 feet at mean high water, from Portsmouth Harbor up to the foot of the Lower Narrows in Cocheco River, distant about 1½ miles below the lowest bridge at Dover. At the Lower Narrows, and above, navigation has been much impeded by ledges, bowlders, and shoals, having from 6 inches to 2 feet only of water on them at mean low water; the mean rise and fall of the tides being 6½ feet at the Packet Landing, the head of navigation.

The original project for the improvement of this river, based on an examination made in 1870, consisted of making a channel not less than 40 feet in width, and 4 feet in depth at mean low water, from the foot of the Lower Narrows up to Collins's Wharf (at the head of the Upper Narrows); the estimated cost of which was $45,000, as shown in the Annual Report of 1871. More accurate and extended surveys, since made, have shown the practicability and importance of extending this improvement up to the Packet Landing; the total estimate of which, as amended, was $85,000. This sum was appropriated by Congress between 1871 and 1878, and in November, 1878, all the improvements then projected for the improvement of this river were completed. These improvements opened up a large amount of commerce, employing several vessels of large size where previously flat-boats or gondolas were used or towed. Owing to the abrupt turns in the channel at the "Lower Narrows," these large vessels have met with much difficulty in passing that place; certain portions of the new channels were also found too narrow and shallow.

The greatly increased trade of the river, due to the improvements made previous to 1879, drew the attention of the Dover Board of Trade to the importance of removing these difficulties, an opinion fully concurred in by General Thom, the engineer then in charge, who recommended a special survey as the basis of an estimate and project for the necessary work, which survey was ordered and executed, and the amount of the estimate ($28,000) was appropriated August 2, 1882.

The project, as approved, was as follows:

Making at the "Lower Narrows" a cut-off channel through Alley's Point, with straight connecting channels above and below.

Widening to 60 feet and deepening to 5 feet the existing channels through Trickey's Shoal and Clement's Point Shoal.

These two items were estimated to cost, including contingencies.....	$24,000
Removing sunken rocks, &c., elsewhere.....	4,000
Total.....	28,000

This last item was recommended to be done by a hired submarine party, contract being impracticable on account of its indefinite character.

It became, of course, necessary to procure, by warranty deed, a right of way through Alley's Point for the proposed cut-off. This was done without cost to the United States, but the delay in connection with it involved a corresponding delay in contracting for the cut-off and channels, which could not be done until May 4, 1883.

At the opening of proposals on the 2d of May, there were but two bidders for the work. The figures of the lowest bid were higher than those of the original estimate, but not so much as to justify their rejection on the ground of extravagance, and the bid was therefore accepted. The desire to avoid further delay in the commencement of the work, already too great, had its influence in this decision. The other bidder made some extraordinary blundering in his figures, which he charged to a copyist. Had they been as he intended he would have had the contract. These statements, otherwise unnecessary, are given to

explain why the sum estimated and appropriated to complete the work is likely to prove insufficient for the purpose.

The project included an item for "the removal of sunken rocks, &c., elsewhere" than in the new channels to be opened, $4,000. In the progress of the work so far, heavy bowlders beyond the power of a dredge have been found, and must be removed otherwise. These, and those "elsewhere," will, it is believed, require more funds than will be available, after the execution of the contract work. Had the bidder just referred to used the figures which he says he intended, and had his bid been otherwise regular, which it was not, the appropriation would have been ample. I am therefore obliged to ask for an additional appropriation of $4,000.

The work under the contract is proceeding satisfactorily. Up to the 30th of June the following progress had been made: 12,260 cubic yards of material have been removed by ordinary earth excavation and by dredging; roughing out the "cut-off" through Alley's Point down to high-water line, and completing the new channel below the "cut-off" to its proper width and depth, leaving only its side slopes unfinished. In making this channel, a few heavy bowlders have been met with, which will probably have to be broken up by blasting by day labor.

The business of Dover and its increase, due to the improvements of the Cocheco by the United States, are set forth in a communication just received from a committee of the Dover Board of Trade, a copy of which accompanies this report.

I am not prepared to give an estimate of the cost of making the additional improvements asked for in this communication; to do this will require an examination which is not practicable to make at present. I will endeavor, however, to have it made later in the season and will submit the result to the Department.

Money statement.

Amount appropriated by act passed August 2, 1882		$28,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$8,757 44	
July 1, 1873, outstanding liabilities	1,999 40	
		10,756 84
July 1, 1883, amount available		17,243 16
Amount (estimated) required for completion of existing project		4,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		4,000 00

Abstract af proposals received May 2, 1883, for the improvement of Cocheco River, New Hampshire.

No.	Bidders.	Residence.	Excavating above high-water cut-off through Alley's Point; 3,700 cubic yards measured *in situ.*	Dredging channel through, above and below the cut-off; 16,000 cubic yards measured *in situ.*	Dredging channels at Trickey's Shoal and Clement's Point; 3,260 cubic yards measured *in situ.*
			Per cu. yd.	*Per cu. yd.*	*Per cu. yd.*
1	Robert Hamilton, jr., and Solomon Sawyer.	Cumberland, Me., Yarmouth, Me.	$0 40	$0 95	$2 48
2	Thomas Symonds	Leominster, Mass.	1 35	2 75	2 00

Contract awarded to Robert Hamilton, jr., and Solomon Sawyer, dated May 4, 1883.

LETTER OF COMMITTEE OF BOARD OF TRADE OF DOVER, NEW HAMPSHIRE.

DOVER, N. H., *June* 27, 1883.

RESPECTED SIR: In answer to your inquiry as to effect on Dover of the Government improvements already completed, we have to say: Prior to 1876 there were but three small schooners owned and coming to Packet Landing occasionally with coal, lime, and cement; value not over $12,000. During the season of 1876 C. H. Trickey & Co. chartered the first foreign schooner (to Dover) to bring coal to them from New York. Previous to 1877 the Cocheco Manufacturing Company brought all coal to their manufactory on lighters from wharves at Portsmouth; amount, about 6,000 tons. The spring of 1877 they had constructed on the south side of Packet Landing a fine stone wharf and a coal-pocket of some 10,000 tons capacity, which would have been done but for the river improvements. They have since secured other valuable land and wharf property on the north side of the river.

We have no doubt they have in contemplation a large store-house for cotton as soon as the present and contemplated Government improvements are completed. The Cocheco Manufacturing Company have nearly, if not quite, doubled their capital and production in the last ten years, largely induced, we have no doubt, by the river improvements, which when completed will enable them to bring their cotton direct from all the cotton ports to their manufactory.

The Cocheco Manufacturing Company's average consumption of coal in the past two years was 13,000 tons, which is brought direct to their works; which amount will be largely increased the present season.

By the improvements on the river the cost of coal to the entire community has been lessened at least 50 cents per ton.

Since the spring of 1878 Dover has had constructed five first-class schooners of a value of nearly $100,000, which have come to us only when the case was urgent, owing to the risk at Alley's Point and some others, which we trust will soon be remedied. When the contemplated improvements are completed doubtless the enterprise will be continued. There is also a valuable tow-boat finding continual employment on the river, which could not have been but for the river improvements.

Since our river improvements commenced there have been several new coal-pockets and store-houses constructed, and where a few years ago there was great quiet now all is bustle and business activity. The growth of business on the river from 1876 to 1881 was gradual. That season there were some one hundred and fifty arrivals; one with cotton from Mobile, one with hard pine from Georgia, some forty with lumber, lime, and cement, the balance with coal from Philadelphia, Baltimore, and New York, amounting to 22,000 tons.

Owing to a rather unsatisfactory state of trade our business of 1882 was somewhat less than 1881. The Cocheco Manufacturing Company discontinuing (for a time only) other large building operations that will increase the river business. There were one hundred and six coal arrivals, bringing 20,000 tons, average value of $6 per ton, delivered here; sixty-two other arrivals covering lumber, cement, lime, stone, and general merchandise, including reshipments at Portsmouth from South Shore Steamship Company.

The new channel at Alley's Point, now so nearly completed, is of very great importance and value to the interests of Dover, thereby giving us a straight channel and avoiding a very crooked, rocky, and dangerous point, hazardous to both vessels and ship-building interests.

Now, in addition to widening and deepening, and removing bowlders from Trickey's Brook Shoal and Clement's Point, allow us to call your attention to several points that to us are of great importance.

We notice by specifications issued of date April 16, no mention is made of giving us the same depth of water between Clement's Point and Clement's Wharf as between Alley's Point and through Clement's Point, which we think of very great importance, as at Clement's Wharf we have good depth of water, the natural stopping point for large cargoes of cotton, lumber, or for vessels coming to load with ice.

We also think it important that the sides of the 40-foot channel at the "Gulf" be trimmed off; they are now ledge, and were left very sharp and dangerous for vessels making the passage through. The same is required at east end of the steam-mill wharf, also widening and straightening the channel at the west end of the steam-mill wharf, where the channel is narrow and has a very short turn.

Our population increased from a fraction over 9,000 in 1870 to 12,000 in 1880. The past river improvements have been of great benefit to Dover and the surrounding country, and when those in contemplation are completed we expect much greater.

Respectfully submitted.

J. S. WALLINGFORD,
G. V. WOODMAN,
CHAS. H. TRICKEY,
River and Harbor Committee Dover Board of Trade.

Col. CHARLES E. BLUNT,
Corps of Engineers, U. S. A.

A 14.

IMPROVEMENT OF PORTSMOUTH HARBOR, NEW HAMPSHIRE.

The work projected for the improvement of this harbor, was:

1. A rubble-stone breakwater for closing the side channel between Great Island and Goat Island, near the "Third Bridge," so as to stop the strong tidal current through it, by which vessels coming up the harbor were liable to be thrown upon Goat Island Ledge, which projects far into the channel, here quite narrow, thereby creating one of the greatest difficulties encountered in entering this harbor.

2. Breaking up and removing Gangway Rock, lying in the channel between "South Beacon Shoal" and the navy-yard. The shoalest part of this rock has but 12 feet of water on it at mean low water, and 20½ feet at mean high water, and only 9.7 feet at *extreme* low water of spring-tides. Owing to the strong tidal currents in this harbor, Gangway Rock has proved to be a serious difficulty to navigation, and especially so to United States vessels which have visited this port and the navy-yard. It is projected to remove this rock to a depth of 20 feet at mean low water (making 28½ feet at mean high water), especially in the interests of United States vessels, a greater depth not having been adopted on account of the great increase of cost attending it. This improvement would increase the width of the channel, for the projected depth, about 370 feet, which would be of great benefit to this part of the harbor.

3. The removal, in part, of the ledge at the southwest point of Badger's Island. This ledge projects into the channel about 150 feet, where it has only about 4 feet of water at mean low water. It thereby presents serious difficulties to vessels coming down the harbor on the ebb-tide, which, after passing Noble's Island, and in their endeavors to avoid being thrown by the powerful current upon the projecting point of Portsmouth, opposite Badger's Island, are very liable to be, and sometimes have been, thrown upon the point of ledge which projects from Badger's Island. To prevent this difficulty it is projected to remove this ledge for a length of 135 feet to a depth of 10 feet at mean low water, which would give 7.7 feet at extreme low water at spring tides.

For the improvements projected as above the following estimates of cost have been submitted, viz:

1. For the breakwater between Goat Island and Great Island	$12,600
2. Breaking up and removing Gangway Rock to a depth of 20 feet, at mean low water, 2,840 cubic yards, at $30 per cubic yard	85,200
3. Breaking up and removing ledges at the southwest point of Badger's Island, 1,190 cubic yards, at $30 per cubic yard	35,700
Adding for engineering expenses, superintendence, and other contingencies, say	16,500
Total	150,000

Of these items, No. 1 has been completed (in November, 1880); of item No. 2, 800 cubic yards, and of item No. 3, 300 cubic yards have been removed, involving a total expenditure up to June 30, 1883, of $43,798.90, the appropriations having been as follows:

By the river and harbor act of March 3, 1879	$10,000
By the river and harbor act of June 14, 1880	25,000
By the river and harbor act of March 3, 1881	20,000
By the river and harbor act of August 2, 1882	17,000
Total	72,000

At the beginning of the past fiscal year, Mr. Isaac A. Sylvester, of Newton, Mass., was at work on Gangway Rock (item No. 2) under his contract of August 23, 1880, for the removal of about 700 cubic yards, at $27.50 per yard. On the 30th of September, 1882, he completed this contract, having removed during the year 340 cubic yards of this rock. On the 16th of October, 1882, a contract was made with Mr. Solon S. Andrews, of Biddeford, Me., for the breaking up and removal of 700 cubic yards of Gangway Rock at $34.50 per cubic yard; the late date in the fall in which this contract was made, and the long continuance of severe and stormy weather in the spring of 1883, prevented the commencement of work under it until May 1, 1883, between which date and the close of the fiscal year he has removed 100 cubic yards of rock, making the total removal during the year under both contracts of 440 cubic yards.

The work upon this rock is a slow and difficult operation on account of the violent tidal currents. An accident similar to the one reported last year happened a very few days after Mr. Andrews resumed work last spring, a schooner loaded with brick having run into his platform, causing a loss to him of several hundred dollars, and four or five days time. It is not probable that the work under this contract can be completed before the 1st of September, 1884.

At the beginning of the past fiscal year Mr. James Andrews was at work at the southwest point of Badger's Island, under his contract of April, 1882. He stopped for the winter on the 25th of November, 1882, having removed during that period 247½ cubic yards of rock. He resumed operations last spring on the 1st of May, and up to June 30, 1883, had removed 52½ cubic yards of rock, making a total during the year of 250 cubic yards.

The progress of this work is necessarily slow, owing to the same cause as at Gangway Rock, though in a less degree. It is possible, but by no means certain, that this contract will be fully executed before next winter.

It seems to me advisable to confine operations in this harbor to one item of improvement until completed, and I accordingly recommend that whatever sum may be next appropriated be expended on the further (or, if the funds will admit, the *entire*) removal of Gangway Rock, leaving other points for attention afterwards.

The several works above named are located in the collection district of Portsmouth of which Portsmouth is the port of entry. The nearest light-houses are Portsmouth Harbor light and Whaleback light, at the outer entrance of the harbor. The nearest forts are Fort McClary and Fort Constitution, in the lower harbor. The United States navy-yard at Kittery, Me., is also in this harbor.

The following information as to the revenue and commerce of the port of Portsmouth, N. H., for the year ending December 31, 1882, has been furnished by the United States collector of customs at that port, viz:

Amount of revenue collected, $50,217.24.

The principal imports on which duty was collected were wool, barley, coal, and salt.

There is no merchandise exported from this port. The foreign arrivals during the above period were 68; departures, 61.

The coastwise arrivals and departures during same period were 850.

There was one vessel built; tonnage, 591.

The whole commerce of the port will be benefited by the improvements proposed, and now in progress in this harbor.

Money statement.

July 1, 1882, amount available		$30,419 14
Amount appropriated by act passed August 2, 1882		17,000 00
		47,419 14
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$17,988 04	
July 1, 1883, outstanding liabilities	1,230 00	
		19,218 04
July 1, 1883, amount available		28,201 10
Amount (estimated) required for completion of existing project		83,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		50,000 00

Abstract of proposals received October 11, 1882, *for removal, in part, of Gangway Rock, about 700 cubic yards sunken ledge, in Portsmouth Harbor, New Hampshire.*

No.	Bidders.	Residence.	Price per cubic yard measured *in situ.*
1	Solon S. Andrews	Biddeford, Me	$34 50
2	Isaac Hamilton and Gardner Floyd	Portland, Me	37 00
3	Robert G. Sylvester	Kittery, Me	37 47
4	George W. Townsend	Boston, Mass	42 00

Contract awarded to Solon S. Andrews; dated October 16, 1882.

APPENDIX B.

IMPROVEMENT OF HARBORS AND RIVERS IN MASSACHUSETTS.

REPORT OF MAJOR CHARLES W. RAYMOND, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1883, *WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

1. Newburyport Harbor, Massachusetts.
2. Merrimac River, Massachusetts.
3. Scituate Harbor, Massachusetts.
4. Boston Harbor, Massachusetts.
5. Plymouth Harbor, Massachusetts.
6. Provincetown Harbor, Massachusetts.
7. Lynn Harbor, Massachusetts.
8. Malden River, Massachusetts.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., July 27, 1883.

GENERAL: I have the honor to submit herewith my annual report for the works of river and harbor improvement under my charge during the fiscal year ending June 30, 1883.

I am, general, very respectfully, your obedient servant,

CHAS. W. RAYMOND,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

B 1.

IMPROVEMENT OF NEWBURYPORT HARBOR, MASSACHUSETTS.

The charge of this work was transferred to me by Col. George Thom, Corps of Engineers, January 18, 1883, in compliance with Special Orders No. 1, Headquarters of the Army, Adjutant-General's Office, Washington, January 2, 1883.

The object of this improvement is to create at the outer bar a permanent channel of 1,000 feet in width at its entrance, with a depth of not less than 17 feet at mean low-water, or 24½ feet at mean high-water. The project adopted to accomplish this object is to build out from the shores, north and south of the harbor outlet, two converging rubble-stone jetties so located as to give proper direction to the channel, and by scour to produce the desired depth. The proposed location of these jetties, and their form and dimensions are shown on the map in the Report of the Chief of Engineers for the year 1881.

The estimated cost of the improvement under the plan adopted is

$365,000, in furtherance of which the following appropriations have been made by Congress, to wit:

By the river and harbor act of June 14, 1880	$50,000
By the river and harbor act of March 3, 1881	40,000
By the river and harbor act of August 2, 1882	40,000
Total	130,000

Under contract of June 23, 1881, with Mr. Edward P. Shaw, of Newburyport, Mass., $48{,}166\frac{160}{2240}$ tons of rubble-stone have been placed in extension of the north jetty, by means of which it has been built out for a distance of 1,540 feet to full height and cross-section, and a submerged core, reaching to the plane of low-water, has been built 500 feet in advance of the finished work, thereby protecting the bottom from scour. Of this work 340 feet were built, and the 1,200 feet partly constructed in 1882 have been built up to full height and cross-section as designed, and the submerged core advanced 500 feet further during the fiscal year ending June 30, 1883.

This contract was closed April 30, 1883.

On December 28, 1882, a contract was entered into with Messrs. Isaac Hamilton and Samuel Teague, both of Portland, Me., for the construction of a dike across "the basin" at Plum Island, Newburyport Harbor. The object of this dike is to prevent the opening of a new channel should the outer shore be broken through. Its location and the details of its construction are shown on the accompanying map.

Under this contract 817 linear feet of dike have been partly completed, and the central opening is so far under way as to obviate all danger of scour in closing the opening.

A contract was entered into January 23, 1883, with Messrs. Thomas A. Rowe and Robert G. Sylvester, both of Boston, Mass., for furnishing stone for the south jetty at Plum Island, and modified, with the approval of the Chief of Engineers, March 26, 1883, for the construction of a water-tight sheet-piling in the shore extension of the south jetty at Plum Island. The new location of the south jetty and the dimensions and details of its modified shore extension are shown on the accompanying map. The reasons for the modifications referred to are set forth in my letter to the Chief of Engineers, dated March 8, 1883, which is hereto attached.

Under this contract 507½ linear feet of sheet-piling have been constructed, and the stone work progressed to full height and cross-section for a length of 357 feet.

To facilitate the study of sand movement and for comparison with the survey of July and August, 1880, a detailed hydrographic survey of the bar and entrance to the Merrimac River is in hand.

When the work contracted for is completed, the south jetty will extend to a distance of about 850 feet from its initial point. From this stage of the work, both jetties should be simultaneously pushed to completion; otherwise the difficulty and expense of construction will be much increased by irregularities of scour.

It is therefore recommended that an appropriation of $150,000 be made for the fiscal year ending June 30, 1885, and that this sum be applied to the simultaneous extension of the north and south jetties. It is further recommended that this appropriation be made immediately available.

This work is located in the collection district of Newburyport, Mass., of which Newburyport is the port of entry. The nearest light-house is on Pium Island, at the entrance to the harbor.

The accompanying commercial statistics have been furnished by the collector of customs for the port of Newburyport, Mass.

Money statement.

July 1, 1882, amount available		$45,438 77
Amount appropriated by act passed August 2, 1882		40,000 00
		85,438 77
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$38,861 40	
July 1, 1883, outstanding liabilities	2,682 69	
		41,544 09
July 1, 1883, amount available		43,894 68
Amount (estimated) required for completion of existing project		235,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		150,000 00

Abstract of proposals received in response to advertisement dated December 12, 1882, and opened December 28, 1882, by Col. George Thom, Corps of Engineers, for furnishing and putting in place about 25,000 tons of rubble-stone in the southern jetty at Plum Island, Newburyport Harbor, Massachusetts.

No.	Names of bidders.	Residence.	Price per ton of 2240 pounds.
1	Thomas A. Rowe and Robert G. Sylvester	Boston, Mass	$2 17
2	Newburyport Quarry Company, Edward P. Shaw, president.	Newburyport, Mass	2 34
3	James M. Andrews and Willett Andrews	Biddeford, Me	2 40

Abstract of proposals received in response to advertisement dated December 12, 1882, and opened December 28, 1882, by Col. George Thom, Corps of Engineers, for the construction of a dike across "the basin" in Newburyport Harbor, Massachusetts.

No.	Names and residences of bidders.	White-oak piles (1,250 linear feet).	Sawed spruce timber (17,750 feet, B. M.).	Sheet-piling, spruce (30,400 feet, B. M.).	Wrought-iron screw bolts, nuts, and washers (3,330 pounds).	Wrought-iron spikes (1,870 pounds).	Small granite quarry grout and quarry chips (3,000 tons).	Total.
		Per foot.	*Per M.*	*Per M.*	*Per lb.*	*Per lb.*	*Per ton.*	
1	Isaac Hamilton and Samuel Teague, both of Portland, Me.	$0 47	$30 00	$45 00	$0 07	$0 04	$1 75	$8,045 90
2	Newburyport Quarry Company, of Newburyport, Mass., Edward P. Shaw, president.	75	40 00	65 00	06	05	1 94	9,736 80
3	Thomas A. Rowe and Robert G. Sylvester, both of Boston, Mass.	2 00	60 00	160 00	10	10	1 73	14,139 00

ABSTRACT OF CONTRACT FOR IMPROVING HARBOR AT NEWBURYPORT, MASSACHUSETTS, DURING THE FISCAL YEAR ENDING JUNE 30, 1883, MADE BY COLONEL GEORGE THOM, CORPS OF ENGINEERS.

Contract with Isaac Hamilton and Samuel Teague, both of Portland, Me., dated December 28, 1882, and expiring June 30, 1883, for the construction of a dike across "the basin," as follows:

For furnishing and putting in place—

1. Oak piles, for 47 cents per linear foot, as measured in the work.
2. Spruce timber, for $30 per M feet, B. M., as measured in the work.
3. Sheet-piling, for $45 per M feet, B. M., as measured in the work.
4. Wrought-iron screw bolts, nuts, and washers, for 7 cents per pound, in the work.
5. Wrought-iron spikes, for 4 cents per pound, in the work.
6. Small granite quarry grout and quarry chips, for $1.75 per ton of 2,240 pounds, placed in the work.

ABSTRACT OF CONTRACT FOR IMPROVING HARBOR AT NEWBURYPORT, MASSACHUSETTS, DURING THE FISCAL YEAR ENDING JUNE 30, 1883, BY MAJOR CHARLES W. RAYMOND, CORPS OF ENGINEERS.

Contract with Thomas A. Rowe and Robert G. Sylvester, both of Boston, Mass., dated January 20, 1883, and modified March 26, 1883, and expiring August 31, 1883, for furnishing and putting in place stone and constructing a water-tight sheet-piling in the shore extension of the south jetty at Plum Island as follows:

1. Granite quarry grout for $2.17 per ton of 2,240 pounds.
2. Spruce sheet piles for $70 per M feet, B. M., including cost of excavation.

MODIFIED PROJECT OF MAJOR CHARLES W. RAYMOND, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., March 8, 1883.

GENERAL: I have the honor to submit for your consideration the following proposed modification of the existing project for the improvement of Newburyport Harbor, Massachusetts.

This improvement was reported upon by the Board of Engineers, under date of October 4, 1880, and the project of Col. George Thom, Corps of Engineers, was approved. The report of the Board and the letter of Colonel Thom on this subject are given in the Report of the Chief of Engineers for 1881, Part I, pages 505–511, and a map showing the improvement faces page 502.

It is proposed to construct two converging jetties at the mouth of the Merrimac River, one extending from the north shore, at Salisbury Point, and the other from the south shore, at Plum Island Point, as shown on the map above mentioned. Their object is to contract the water-way, so as to increase the scour of the outflowing current sufficiently to obtain 13½ feet minimum depth at mean low-water across the bar.

The north jetty, starting from Salisbury Point, has already been completed for a distance of 1,540 feet, and a core has been advanced for a further distance of 460 feet.

Work will be commenced on the south jetty, starting from Plum Island Point, on April 1, 1883, under a contract made by myself with Messrs. Thomas A. Rowe and Robert G. Sylvester, and approved by the Department February 2, 1883. The position of the south jetty, as proposed in 1881, is shown on the tracing herewith transmitted.* A survey, however, made in July, 1882, showed that Plum Island Point had shifted to the northwestward. The jetty was accordingly relocated, as shown on the tracing; and it was with reference to the latter position that the specifications were drawn for the existing contract.

The proposed plan of construction is briefly as follows: In order to check the action of the sea upon Plum Island Point and hold the initial point of the jetty in position, an apron is first to be constructed, extending around the point between the high and low water lines. It is to be about 80 feet in width, and consist of blocks of "granite quarry grout," each weighing at least half a ton; one-half of the blocks averaging in weight not less than 2 tons, and the other half weighing not less than 2 tons each. From the initial point thus established the "shore extension" is to be carried forward exactly as in the case of the north jetty. A sketch of the "shore protection" referred to is shown in plan on the tracing.

The contract with Messrs. Rowe and Sylvester was made by me im-

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*The tracing transmitted with letter is not published, as the principal points referred to are shown on the map accompanying this report.

mediately after relieving Colonel Thom of charge of the work, and after as careful an examination and discussion as circumstances would permit. It had been necessarily delayed, and justice to the contractors required its immediate completion.

Since that time, however, I have studied on the ground the changes which have occurred and are now in progress, and this investigation leads me to the belief that it is desirable to modify the existing project as far as the location of the jetty and the character and position of the "shore protection" are concerned.

In its report of October 4, 1880, the Board refers to the movement of the sands along the shore as being southward with the winds from the north around to the east, and northward with the winds from the south to the east. This is undoubtedly the case; but it is further to be remarked that the changes at Plum Island have taken place in a northerly or northwesterly direction, being probably due in a great degree to the littoral current moving northward or northeastward at all stages of the tide, combined with the influence of southerly winds. The influence of this resultant force is exhibited on the tracing in the various positions of the high-water line as surveyed from 1827 to the present time. The rapid character of the changes in progress at this point is shown by its change of position between July, 1882, and February, 1883.

The objections to the shore protection as proposed are briefly as follows:

I. The action of the sea at this exposed point is so energetic that probably the sand will be washed away through and behind the apron, leaving it isolated or gradually undermining it and lowering it beneath the surface of the water.

II. Owing to the necessity of placing the front of the apron some 80 feet beyond the high-water line, its actual construction will be difficult.

III. Owing to the change in form and position of the point to be protected, the rear of the apron will be swept by the waves, unless protected by a return from its eastern flank.

For these reasons I respectfully suggest the following changes:

I. I propose to omit the apron, substituting therefor a shore protection constructed as follows: A trench, extending a little below the level of mean high-water, is to be excavated in the shore prolongation of the axis of the proposed jetty. In this 6-inch sheet piling is to be driven to a distance of about 2 feet below low-water. Over the piling and in the trench is to be constructed a groin, composed of granite quarry grout. The details of this shore protection are shown on the tracing herewith transmitted. The object of the sheet piling is to pin the groin in position, and keep the water from washing through it. The object of the trench is to facilitate the driving of the piles. Should the action of the sea remove the sand from beneath the stones, it is believed that they will simply sink down in position around the piling, and if necessary the groin may be readily replenished at the top. The sheet piling will begin at a point just above the "storm crest," or line of highest action of the waves. From this point it will be carried forward towards the water, the stone being placed upon it as it advances, until finally the initial point of the jetty is reached.

When the jetty has been fairly advanced from the shore the sand will doubtless fill in at the angle between the shore and jetty under the action of the winds and littoral current, as it has already done in the case of the north jetty at Salisbury Point, thus assuring the stability of the initial point and shore.

II. From a careful study made on the ground, the position of the jetty

has been located, as shown on the tracing at A. This position is selected with special reference to economy in the construction of the shore protection, which will here require 500 feet of sheet-piling.

With regard to the economy of this construction, I respectfully invite attention to the following points:

The existing contract calls for the delivery in position of 20,000 tons of stone, more or less, at $2.17 per ton. The apron as originally proposed will require at least 16,000 tons, leaving 4,000 tons to go into the jetty proper. This would advance the latter about 138 feet.

The plan now proposed requires about 7,000 tons in the shore protection. The excavation of the trench will cost about $475, and the sheet-piling about $3,000. These two items, therefore, are equal in cost to about 1,600 tons of stone at $2.17 per ton. Thus we have remaining 11,400 tons to go into the jetty, which will advance it about 356 feet.

The Board of Engineers in its report of October 4, 1880, do not indicate the exact location of the jetties or the character and extent of the shore protection, but remark in effect that these may be left for the decision of the engineer officer in charge. I feel great hesitation, however, in making decided changes in the plans of an officer of high ability and long experience, even though these changes seem justified by the introduction of new conditions, without the approval of the Department.

I have, therefore, the honor to request the instructions of the Department with reference to this work.

Very respectfully, your obedient servant,

CHAS. W. RAYMOND,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, NEWBURYPORT,
Collector's Office, June 30, 1883.

DEAR SIR: In compliance with your request under date of June 12, 1883, for commercial statistics for Merrimac River and its harbor at Newburyport, Mass., I would respectfully report for the fiscal year ending June 30, 1883:

I. Amount of revenue collected $5,544 57

II. Entrances and clearances with tonnage of the same—

	Vessels.	Tons.
Foreign entrances	42	5,524.89
Foreign clearances	49	6,750.52
Domestic entrances (coastwise)	396	91,759.00
Domestic clearances (coastwise)	347	97,082.00
Fishing entrances	227	6,612.00
Fishing clearances	232	7,016.00
Total	1,293	214,744.41

III. Other items of interest:

Foreign imports:		
Coal (culm and bituminous)	tons..	8,175
Lumber:		
Clapboards		252,275
Shingles		55,280
Laths		490,000
Boards	feet..	48,000
Plank	do...	64,828
Cedar posts	do...	1,300
Potatoes	bushels..	6,820
Turnips	do...	570
Eggs	dozen..	237

NEWBURYPORT HARBOR, MASS.

PLAN

showing changes in shore lines at entrance, the location and condition of the jetties, and the details of the South Jetty and Dyke.

TO ACCOMPANY ANNUAL REPORT OF

Major C. W. Raymond, Corps of Engineers,

for 1883

SCALE OF PLAN.

1000 500 0 1000 2000 3000 Ft.

The soundings are expressed in feet and tenths and are referred to the plane of mean low water.

Mean Rise and Fall of Tides . . . . . 7.7 Ft.

Highest observed Tide above mean low water . . . 9.4 "

o-o-o-o-o-o indicates High Water Line 1851, U.S.C.S.

..... " " " " 1878, U.S.C.S.

— — — — " " " " 1880, U.S.E.

//////// " " " " 1883, U.S.E.

Vertical Scale of Sections (Also horiz! Scale of Cross Sections).

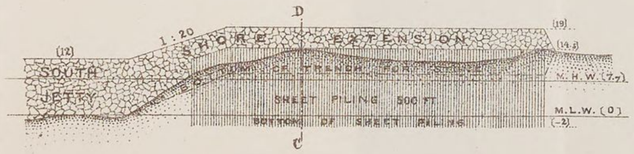
5 0 10 20 30 50 60 70 80 90 100 FT.

Horizontal Scale for Longitudinal Sections.

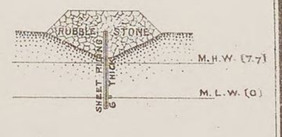
50 0 100 200 300 400 500 600 700 FT.

SHORE EXTENSION OF SOUTH JETTY

LONGITUDINAL SECTION a-b.

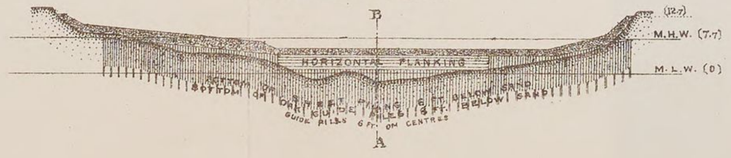


CROSS SECTION AT C-D

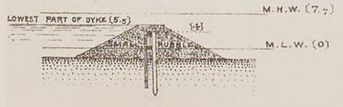


DYKE ACROSS THE BASIN

LONGITUDINAL SECTION



CROSS SECTION AT A-B



Low Beach, in heavy gales with high tide sea dashes through the dune.

III. Other items of interest—Continued.

Domestic imports:		
Coal (anthracite)	tons..	115,000
Lumber	feet..	4,200,000

Besides bricks, lime, cement, stone, &c.

I am, respectfully, &c.,

WILLIAM H. HUSE,
Collector.

CHARLES W. RAYMOND,
Major of Engineers, U. S. A.

B 2.

IMPROVEMENT OF MERRIMAC RIVER, MASSACHUSETTS.

The charge of this work was transferred to me by Col. George Thom, Corps of Engineers, January 18, 1883, in compliance with Special Order No. 1, Headquarters of the Army, Adjutant-General's Office, Washington, January 2, 1883.

The present project for the improvement of this river was adopted in 1870, and modified in 1874; the object being to afford a channel of navigable width, and a depth of not less than 9 feet at mean low water (or about 16½ feet at mean high water), from Plum Island light, near its mouth, up to Deer Island Bridge, a distance of about 5 miles, and thence up to Haverhill Bridge (an additional distance of 12½ miles), a *depth* of 12 feet at ordinary high water, the rise and fall of tides varying from 7½ to 4 feet; thence from Haverhill Bridge to the foot of Mitchell's Falls (an additional distance of 1½ miles), a depth of 10 feet at ordinary high water; and thence through Mitchell's Falls to the head of the Upper Falls (an additional distance of 2½ miles), a depth of not less than 4½ feet in the ordinary stages of the river, with the mill-water at Lawrence running, or a total distance of 21½ miles of improved channel.

The natural channel of the river was very narrow and crooked in several places, and much obstructed by sunken ledges, bowlders, and shoals, especially at the falls, portions of which were covered with bowlders and ledges, more or less bare; while in Newburyport Harbor the channel was obstructed by numerous sunken ledges, crib-work, piers, and wrecks.

The estimated cost of the improvement under the amended project of 1874 was $147,000, in furtherance of which the following appropriations have been made by Congress, to wit:

By acts from July 11, 1870, to June 18, 1878	$132,000
By the river and harbor act of March 3, 1879	5,000
By the river and harbor act of June 14, 1880	12,000
By the river and harbor act of March 3, 1881	9,000
By river and harbor act of August 2, 1882	9,000
Total	167,000

By aid of these appropriations, at the close of the fiscal year ending June 30, 1882, the work of improvement had been advanced toward completion as follows:

The channel above Haverhill and through the falls nearly completed to the projected width and depth; the shoals deepened by dredging, between the bridges at Haverhill, Silsby's Island, Plain Point Shoal, Currier's Shoal (about 4 miles below Haverhill Bridge), and at Rocks Bridge (about 6¾ miles below Haverhill); also numerous sunken rocks

removed at Rocks Bridge and Silsby's Island, Gangway Rock, and South Gangway Rock, in Newburyport Harbor, broken up and removed to a depth of 9 feet at mean low water, and the removal of North Rocks to the same grade, in part completed.

Operations for the fiscal year ending June 30, 1883, for continuing the improvement, have been as follows:

The contract with Messrs. Trumbull and Cheney, of Boston, Mass., dated June 20, 1881, for the removal of South Badger Ledge and North Rock Spur was abandoned by them after the removal of North Rock Spur and the removal in part of South Badger Ledge. With a submarine party and a dredging machine employed during the summer of 1882, the channel at the Lower Falls, above Haverhill, as well as at Rocks Bridge, has been much improved by dredging and the removal of dangerous sunken rocks. On October 2, 1882, contract was entered into with Messrs. Isaac Hamilton and Gardner Floyd, both of Portland, Me., for the further improvement of the river. Under this contract the ledge known as South Badger Ledge has been broken up and removed to a depth of 9½ feet at mean low water, and under the contract with Mr. George W. Townsend, of Boston, Mass., dated October 4, 1882, of the ledge known as North Rock, 50 cubic yards (out of 150 cubic yards to be removed) have been broken up and removed to a depth of 9 feet at mean low water. A survey and map of the channel at Rocks Bridge, with a view to conform to the new conditions consequent upon the relocating and rebuilding of the drawbridge at that point has been made, details of which are fully set forth in the report of Mr. Sophus Haagensen, assistant engineer, herewith submitted.

To complete the improvement of the river from the head of the falls to its mouth at Plum Island light, the cost is estimated as follows:

1. Removing sunken rocks and shoals in "The Falls," above Haverhill	$1,500 00
2. Clearing a new channel at Rocks Bridge conforming to the new draw, as now being rebuilt	3,500 00
3. Breaking up and removing the "The Boilers" in Newburyport harbor to a depth of 5 feet at mean low-water, 350 cubic yards, at $25	8,750 00
4. Completing removal of "North Rock" (now under contract), 100 cubic yards, at $35	3,500 00
Engineering and contingencies	2,079 91
Total	19,329 91
Less amount available July 1, 1883	4,329 91
	15,000 00

But to complete the improvement so that the same depth of water which has been obtained through Mitchell's Falls can be carried to Lawrence (distant 5 miles from the head of "The Falls"), additional work will remain to be done, estimated by Col. George Thom, Corps of Engineers, in 1882, as follows:

Dredging channel through "Gage's Ferry Shoal" and "Andover Bar," and removing sunken bowlders and sunken ledges, $11,000.

To recapitulate: Improving the channel of the river from its mouth at Plum Island light to Lawrence, a distance of 26½ miles, the amount required is as follows:

Completing the existing project, 21½ miles of river from its mouth to head of the falls	$15,000
Continuing the improvement from the "Head of the Falls," up to Lawrence, Mass., an additional distance of 5 miles	11,000
Total	26,000

This amount, if appropriated, can be profitably expended during the fiscal year ending June 30, 1885.

This work is located in the collection district of Newburyport, Mass., of which Newburyport is the nearest port of entry. The nearest light-house is on Plum Island, at the mouth of the river.

The accompanying commercial statistics for the fiscal year ending June 30, 1883, have been furnished by the collector of customs for the port of Newburyport, Mass.:

Money statement.

July 1, 1882, amount available		$3,353 79
Amount appropriated by act passed August 2, 1882		9,000 00
		12,353 79
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$7,673 88	
July 1, 1883, outstanding liabilities	350 00	
		8,023 88
July 1, 1883, amount available		4,329 91
Amount (estimated) required for completion of existing project		26,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		26,000 00

Abstract of proposals received in response to advertisement dated August 31, 1882, and opened September 15, 1882, by Col. George Thom, Corps of Engineers, for removing "South Badger Ledge" and sunken ledge ("North Rocks").

No.	Names of bidders.	Residence.	Removal of sunken ledge (North Rocks). Price *in situ.*	Removal of "South Badger Ledge." Price *in situ.*
			Per cu. yd.	*Per cu. yd.*
1	George W. Townsend	Boston, Mass	$35 00	
2	Isaac A. Sylwester	Newton, Mass	39 90	
3	Isaac Hamilton and Gardner Floyd	Portland, Me	49 00	$110

Abstract of contracts made during the fiscal year ending June 30, 1883, for improving Merrimac River, Massachusetts, by Col. George Thom, Corps of Engineers.

Date of contract.	Contractors.	Nature of work.	Price, measured *in situ.*
1882.			*Per cu. yd.*
Oct. 2	Isaac Hamilton and Gardner Floyd, Portland, Me.	Breaking up and removing "South Badger Ledge."	$110
Oct. 4	George W. Townsend, Boston, Mass...	Breaking up and removing sunken ledge, "North Rocks."	35

REPORT OF MR. SOPHUS HAAGENSEN, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., June 15, 1883.

MAJOR: I have the honor to report upon the survey of the channel of Merrimac River at Rocks Bridge (East Haverhill), Mass., made according to your verbal instructions in May, 1883.

The high-water lines and shore points were surveyed with the plane table, and the ranges for sounding established so as to cover the shoal ground at intervals of not less than 50 feet.

The accompanying map, drawn to a scale of 1:2,000, shows the soundings which are referred to mean high water. The mean rise and fall of tide is 6 feet. The bench-mark is a railroad spike driven in the down-river side of the crib foundation of the pier nearest the East Haverhill shore. It is in grade 9.0 (mean high-water being 12.0), or 3.0 feet below the plane of reference for the soundings.

The soundings are all taken with sounding pole, and their location on the range determined by intersection from shore stations.

The character of the bottom is gravel and cobblestone, with large bowlders intermixed.

The most dangerous bowlders, as "Petty Rock" and "Lime Rock," have previously been removed, as well as a channel cleared by dredging above and below the "Old Draw."

This draw, however, being badly located and too narrow (37 feet wide) for the class of vessels now navigating the river up to Haverhill, a new double draw is being constructed east of the old one, with two openings 57 feet in clear between foundations of draw piers. This new draw is in conformity with the natural channel of the river.

To improve the new channel so that it will correspond in depth with the improved channels between Rocks Bridge and Haverhill, it will be necessary to remove shoals above and below Rocks Bridge.

The area shown on the accompanying map with red parallel shade lines indicates the shoal places (having less depth than 12 feet at mean high-water) within a channel of a least width of 160 feet, which is the length of the draw section.

To dredge this whole area over would require the removal of—

3,430 cubic yards of gravel and bowlders, which, at an estimated expense of $2.50 per cubic yard, would cost	$8,575
Superintendence	760
Adding for contingencies about 10 per cent	965
Would give an expense of	10,300

It is not deemed advisable to spend so much money on this channel.

By buoying the natural channel below the bridge and leaving the lower shoals undredged (they only lack a few tenths in the full depth, 12 feet at mean high water), only removing from these shoals scattered bowlders projecting above the channel bottom, then clearing the channel to 12 feet depth for one opening of the draw, there will be made a channel of a least width of 60 feet (100 feet at the ends) in the line of the westerly draw, while the easterly draw will have a channel of a least depth of 10½ feet at mean high water.

This, it is believed, would give all the facilities needed at present.

The dredging is shown on the map with red crossed shade lines.

The estimated cost of the proposed improvement is as follows:

Removal by dredging of 900 cubic yards of gravel and bowlders, at a cost of $2.50 per cubic yard	$2,250
Removal of scattered bowlders	500
Superintendence	400
Adding for contingencies about 10 per cent	350
Total	3,500

Very respectfully, your obedient servant,

SOPHUS HAAGENSEN,
Assistant Engineer.

Maj. CHAS. W. RAYMOND,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, NEWBURYPORT,
Collector's Office, June 30, 1883.

DEAR SIR: In compliance with your request, under date of June 12, 1883, for "commercial statistics" for Merrimac River and its harbor at Newburyport, Mass., I would respectfully report for the fiscal year ending June 30, 1883:

I. Amount of revenue collected	$5,544 57

II. Entrances and clearances, with tonnage of the same:

	Vessels.	Tons.
Foreign entrances	42	5,524.89
Foreign clearances	49	6,750.52
Domestic entrances (coastwise)	396	91,759.00
Domestic clearances (coastwise)	347	97,082.00
Fishing entrances	227	6,612.00
Fishing clearances	232	7,016.00
Total	1,293	214,744.41

III. Other items of interest:

Foreign imports:		
Coal (culm and bituminous)	tons..	8,175
Lumber, viz:		
Clapboards		252,275
Shingles		55,280
Laths		490,000
Boards	feet..	48,000
Plank	do...	64,828
Cedar posts		1,300
Potatoes	bushels..	6,820
Turnips	do...	570
Eggs	dozen..	237
Domestic imports:		
Coal (anthracite)	tons..	115,000
Lumber	feet..	4,200,000

Besides bricks, lime, cement, stone, &c.

I am, respectfully, &c.,

WILLIAM H. HUSE,
Collector.

CHARLES W. RAYMOND,
Major of Engineers.

B 3.

IMPROVEMENT OF SCITUATE HARBOR, MASSACHUSETTS.

The charge of this work was transferred to me April 6, 1883, by Lieut. Col. George H. Elliot, Corps of Engineers, U. S. A., in compliance with directions of the Chief of Engineers dated April 4, 1883.

The object of this improvement is to make Scituate a harbor of refuge for vessels seeking Boston from the eastward, the intermediate coast being densely studded with dangerous shoals and sunken rocks. This harbor is situate on the west shore of Massachusetts Bay, about midway between Boston and Plymouth lights, distant about 14 miles from each, and about 25 miles from Race Point, in a direction north 22 degrees west.

The project adopted in 1880 is to build two breakwaters, one from Cedar Point, near the old light-house on the north side of the entrance, and the other from the point of the "First Cliff," on the south side of the entrance; these to be built of rubble-stone to a height of 4 feet above mean high water, with a width of 20 feet on top, except at the channel extremities, which are to be raised to a height of 10 feet above mean high water, so as to afford a conspicuous guide to the entrance; at an estimated cost in 1882 of $290,000, which will doubtless have to be increased, owing to the great advance in the cost of material.

In furtherance of this project the following appropriations have been made by Congress, viz:

By the river and harbor act of June 14, 1880	$7,500
By the river and harbor act of March 3, 1881	10,000
By the river and harbor act of August 2, 1882	10,000
Total	27,500

By aid of these appropriations, at the close of the fiscal year ending June 30, 1882, 10,024 tons of rubble-stone had been put in place on the outer portion of the north breakwater for a length of 470 feet, and built up to a height of about 3 feet above mean high water.

Work during the fiscal year ending June 30, 1883, has been as follows:

A contract was entered into September 20, 1882, with Mr. Charles H. Edwards, of Quincy, Mass., for furnishing and putting in place rubble-stone in extension of the north breakwater, and connecting it with the shore. Under this contract 4,953$\frac{1280}{2240}$ tons of stone have been put in place, extending the breakwater a total length of 720 feet, and height of about 4 feet above mean high water. In addition to this, a portion of the beach, between Cedar Point and the main land, which had become dangerously abraded, has been protected by a brush and stone bulkhead for a total length of 450 feet, and a stone apron protection in front of this 385 feet in length and 10 feet in width.

It is proposed to apply further appropriations to continuing the improvement under the approved project, as delineated in the map accompanying the annual report of the Chief of Engineers of 1881, and to this end $75,000 can be profitably expended during the fiscal year ending June 30, 1885, which, if appropriated, it is proposed to expend as follows:

To place 20,000 tons of stone in south breakwater, at $2.15	$43,000
Dredging a channel 2,300 feet long and 100 feet wide, 83,000 cubic yards, scow measurement, at 30 cents	24,900
Engineering and contingencies	7,100
Total	75,000

This work is located in the collection district of Plymouth, Mass. The nearest port of entry is Plymouth. The nearest light-house is Minot's Ledge light, distant about 5 miles.

Money statement.

July 1, 1882, amount available	$203	54
Amount appropriated by act passed August 2, 1882	10,000	00
	10,203	54
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	10,079	91
July 1, 1883, amount available	123	63
Amount (estimated) required for completion of existing project	262,500	00
Amount that can be profitably expended in fiscal year ending June 30, 1885	75,000	00

Abstract of proposals received and opened September 15, 1882, by Col. George Thom, Corps of Engineers, for improving harbor at Scituate, Mass.

No.	Names of bidders.	Residence.	About 5,000 tons of rubble-stone. Large stone between Cedar Point and inner end of present work.	Large stone placed on present work.	Rounded bowlders for core of work.
			Per ton of 2,240 *lbs.*	*Per ton of* 2,240 *lbs.*	*Per ton of* 2,240 *lbs.*
1	Charles H. Edwards	Quincy, Mass	$2 09	$1 70	$1 50
2	George B. Sargent	Quincy Point, Mass	2 23	2 64	.....

ABSTRACT OF CONTRACT FOR IMPROVING HARBOR AT SCITUATE, MASSACHUSETTS, DURING THE FISCAL YEAR ENDING JUNE 30, 1883, BY COLONEL GEORGE THOM, CORPS OF ENGINEERS.

Contract with Charles H. Edwards, of Quincy, Mass., dated September 20, 1882, and expiring December 31, 1882, for furnishing and putting in place rubble-stone in breakwater in Scituate Harbor, as follows:

1. Granite quarry grout, deposited between Cedar Point light-house and the inner end of the present work, for $2.09 per ton of 2,240 pounds; and round bowlders for the core of this work for $1.50 per ton of 2,240 pounds.

2. Granite quarry grout, deposited from its inner end outward, for $1.70 per ton of 2,240 pounds.

COMMERCIAL STATISTICS OF SCITUATE HARBOR, MASSACHUSETTS, FOR THE FISCAL YEAR ENDING JUNE 30, 1883.

Statement of vessels entered and cleared to June 30, 1883.

Number	43
Tonnage	3,739

Tabulated statement of imports and exports at the harbor of Scituate, Mass., for the fiscal year ending June 30, 1883.

Articles.	Imports.		Exports.		Total valuation of imports and exports.
	Quantity.	Valuation.	Quantity.	Valuation.	
Lumber.....feet, b. m..	1,500,000	$45,000	.....	.....	$45,000
Coal.....tons..	1,500	12,000	.....	.....	12,000
Grain.....bushels..	1,400	11,200	.....	.....	11,200
Flour.....barrels..	1,000	8,000	.....	.....	8,000
Molasses.....hogsheads..	30	2,660	.....	.....	2,660
Sugar.....pounds..	9,000	27,000	.....	.....	27,000
Sundries.....	.....	60,000	.....	.....	60,000
Fish.....	.....	5,100	.....	.....	5,100
Carrageen moss.....pounds..	.....	.....	10,000	$60,000	60,000
Manufactures.....	.....	.....	.....	146,877	146,877
Farm products.....	.....	.....	.....	300,000	300,000
Total imports.....	.....	170,960	.....	.....	.....
Total exports.....	.....	.....	.....	506,877	.....
Grand total.....	.....	.....	.....	.....	677,837

NOTE.—The number of vessels reported as passing Scituate Harbor bound in and out of Boston annually is 14,000.

Within the last thirty years it is estimated by the most trustworthy authorities that the number of vessels lost or stranded on the "South Shore" of Massachusetts Bay is 161, valued with their cargoes at $4,000,000. The loss of life consequent upon these disasters aggregates 243. In a single month of the winter of 1878 eight vessels were stranded south of Scituate, resulting in the loss of more than thirty lives.

B 4.

IMPROVEMENT OF BOSTON HARBOR, MASSACHUSETTS.

The charge of this work was transferred to me by Col. George Thom, Corps of Engineers, January 18, 1883, in compliance with Special Order No. 1, Headquarters of the Army, Adjutant-General's Office, Washington, January 2, 1883.

The improvements in this harbor undertaken by the General Government since 1866 were projected from time to time as the interests and necessities of the harbor demanded, being in general conformity with

the recommendations of the United States commissioners, whose labors terminated with that year.

The objects of these improvements have been—

1. The preservation of the islands and headlands by permanent sea-walls or aprons and jetties of rubble-stone for the purpose of protecting the channels against encroachment, controlling the resultant tidal scour, and securing shelter to vessels in roadsteads.

2. The widening, straightening, and deepening of the main ship-channel by dredging, and the removal of dangerous sunken rocks, thereby securing a channel of not less than 600 feet in width, with a depth of 23 feet at mean low water.

3. The widening, deepening, and straightening of the channel in Hingham Harbor, and the removal of sunken ledges, for a width of 100 feet and depth of 8 feet at mean low water.

4. The opening of a channel at the mouth of the Mystic River for a width of 400 feet and depth of 23 feet at mean low water.

5. The widening, deepening, and straightening of the channel from the mouth of Charles River, up to the dam at the head of tide-water, as follows:

a. From its mouth up to Western Avenue Bridge for a width of 200 feet and minimum depth of 7 feet at mean low water, or about 17 feet at mean high water.

b. From Western Avenue Bridge up to Market Street Bridge for a width of 80 feet and minimum depth of 6 feet at mean low water, or about 16 feet at mean high water.

c. From Market Street Bridge up to the dam at the head of tide-water, for a width of 60 feet and minimum depth of 2 feet at mean low water.

6. The widening and deepening of the channel leading up from the harbor to Nantasket Beach wharves for a minimum width of 100 feet, and depth of 9½ feet at mean low water.

7. The removal of sunken rocks and ledges endangering navigation in the main channel, its borders, and approaches.

In furtherance of this project, $1,602,500 have been appropriated by Congress, as follows:

By acts from March 2, 1867, to March 3, 1879	$1,331,000
By acts June 14, 1880 ($30,000 to be expended in Boston Harbor; $22,500 at the mouth of Charles River in said harbor, and up to Watertown; $17,500 at the mouth of Mystic River in said harbor; and $5,000 from said harbor to Nantasket Beach)	75,000
By act March 3, 1881 ($40,000 to be expended in said harbor; $35,000 at the mouth of Charles River in said harbor, and up to Watertown; $20,000 in said harbor at mouth of Mystic River, and $5,000 from said harbor to Nantasket Beach)	100,000
By act passed August 2, 1882, for completing improvement	96,500
Total	1,602,500

By aid of these appropriations, permanent sea-walls have been built at the various islands and headlands in the harbor and rubble-stone has been spread in apron in front of walls, and at their junctions with shore-banks. These have been repaired from time to time, protecting the islands against sea encroachment, and furnishing shelter for vessels in the roadsteads.

Numerous rocks and sunken ledges have been removed from the various channels, their borders, and appproaches. The main channel has been dredged for a width of 600 feet and depth of 23 feet at mean low-water, from its outer entrance to the wharves in Boston.

The Hingham Harbor improvement has been completed.

The channel at the mouth of Mystic River has been dredged to a depth of 23 feet at mean low water, with a minimum width of 375 feet.

The Charles River has been dredged from its mouth up to the Western Avenue Bridge for a width of 200 feet and depth of 7 feet at mean low water.

The channel leading up to Nantasket Beach wharves has been dredged to a depth of 9½ feet at mean low water, with a width of 100 feet, and some rocks and sunken ledges removed.

The following-named surveys and examinations have also been made, viz, Boston Harbor, Hingham Harbor, Anchorage Shoals, shoals at the mouth of Mystic River, Charles River, channel leading up to Nantasket Beach wharves, examination of parts of the channel in the Narrows, resurvey for dredging *in situ* of Charles River from Brighton Street Bridge up to Watertown Bridge, and survey of channel between Nick's Mate and the North Head of Long Island.

By far the greater part of the expenditure in Boston Harbor has been for its preservation rather than for the increase of its navigable capacity.

During the fiscal year ending June 30, 1883, the following work has been done for the improvement of this harbor, viz:

I.—BOSTON HARBOR (PROPER).

Under contract dated January 31, 1882, with the Eastern Dredging Company, of Portland, Me., for dredging at Anchorage Shoals, 40,327 cubic yards of material have been removed, making a total of dredgings under this contract of 65,327 cubic yards removed. This has resulted in securing a channel 23 feet deep at mean low water, or 32.7 feet deep at mean high water, with a width at its eastern end of 1,000 feet, increasing to 1,400 feet in width at its western end.

An examination has been made of parts of the channel in the Narrows (lower harbor), and also a survey of the channel between Nick's Mate and the North Head of Long Island.

The following work has been done in the repair of sea-walls, aprons, and jetties.

1. *North Head of Long Island.*—The rubble-stone apron at the western end of the wall was completed, 370 tons of granite grout and 45 tons of bowlders being placed in position during the year.

The southern end of the wall has been protected by a heavy apron of rubble-stone, with projecting jetties. In this apron there have been placed 420 tons of granite grout and chips, 259 tons being purchased and 161 tons being on hand.

2. *Gallop's Island.*—In the latter part of 1882 the concrete apron and foundation of the sea-wall was repaired and protected wherever necessary by placing additional stone in apron. An apron of rubble-stone, with two jetties, was constructed at the junction of the western end of the wall with the shore and along its western front, the total length being 300 feet. The triangular jetty at the re-entering angle between the eastern faces of the wall was reconstructed, the lower stones being bedded in concrete. The apron at the junction of the eastern end of the wall with the shore was thoroughly reconstructed and its dimensions increased. Its paving stones and the lower stones of the jetty projecting from it have been bedded in concrete. The total length of apron constructed is 190 feet.

During the present working season the following work has been done under the approval of the Department, dated April 7, 1883. The rubble-stone apron at the eastern end of the wall has been widened to 30

feet for a distance of about 60 feet, and a new apron 170 feet in length, with a jetty 32 feet in length, has been constructed.

3. *Lovell's Island.*—During the latter part of 1882 the following work was done: The rubble-stone apron in front of the northern part of the eastern sea-wall was widened and strengthened, its edge stones being bedded in concrete. The concrete apron and foundation of the southern wing wall was repaired. The apron south of the eastern wall was reconstructed, its dimensions being increased and its edge stones bedded in concrete. The total length of apron thus reconstructed and improved is 290 feet, 222 tons of granite grout being placed in position.

During the present working season the following work has been done: Repairs of immediate necessity have been made on the concrete apron and foundation of the northern wall. The three upper courses have been relaid in the dry wall, 40 feet in length, at the eastern end of the northern wall, and a rubble-stone apron 240 feet in length has been built at the shore-crest. The total quantity of stone placed in apron is 1,150 tons.

All the above work has been done by hired labor, and with materials purchased in open market.

The project for the removal of the spur at Castle Island Shoal requires 32,000 cubic yards of dredging. It was approved by the Department under date of April 7, 1883.

After due advertisement, bids were opened for this work on May 21, 1883. The two bids offered being considered excessive, no contract was awarded.

The works of preservation in this harbor, being massive sea-walls, and aprons and jetties of rubble-stone, are of a permanent character. Moderate expenditures, however, are annually required for the repair of injuries inflicted by storms or the continued wear of the sea. In the case of some old walls built before these works were conducted under the direction of the Engineer Department, more extensive repairs or partial reconstruction will be necessary.

The condition and needs of these works at the present time, as determined by an inspection recently made by myself and Mr. H. F. Bothfeld, assistant engineer, are as follows:

1. *Point Allerton.*—This sea-wall was completed in 1873. It is 1,202 feet in length. Its concrete foundation, for a distance of 1,005 feet, is protected by an apron and eight jetties of granite grout. The work is in excellent condition.

2. *Great Brewster Island.*—This wall was completed in 1869. It is 2,840 feet in length. This work is in fair condition, but needs some small repairs. The cost of these is estimated at $150.

3. *Lovell's Island.*—The northern sea-wall was completed in 1843. It is 750 feet long. Its concrete foundation has been much injured by the action of the sea. An apron of rubble-stone, for its protection from further injury, will be required. The estimated cost is $3,000.

The eastern sea-wall was completed in 1869. It is 800 feet in length. It is in excellent condition.

The shore-line south of the western end of the northern wall is protected by an apron of rubble.stone built in 1873. It is 620 feet in length. It is in good condition.

The shore-line next to the southern end of the eastern sea-wall is protected by an apron 190 feet in length. This apron is still under construction. As far as the protection of the wall is concerned, it is in excellent condition. It is proposed to extend this apron for a distance of 1,300 feet for a shore protection. The estimated cost is $16,000-

The abrading action of the sea on the shore north of the eastern wall is even more serious than its action on the southern shore, for in the former case the narrow shore-crest is, on the average, from 1 to 2 feet lower than in the latter. Moreover, the land in rear of the northern shore is much lower than the shore-crest, being in places 1 foot below the plane of mean high water, and generally rising only to the level of high water, or from 1 to 2 feet above it. The southern shore was selected for first protection simply on account of its close proximity to the main ship-channel. It is now proposed to protect the eastern shore north of the eastern sea-wall for a distance of 1,200 feet by a rubble-stone apron and jetties. The estimated cost is $17,000.

4. *Gallop's Island.*—This sea-wall was completed in 1871. It is 1,785½ feet in length. Its foundation is protected by an apron of rubble-stone and nine jetties, completed in 1874. This apron was originally 1,655 feet in length. It has since been extended for the protection of the ends of the wall. The work is in good condition.

It is proposed to continue the construction of the apron and jetties for the protection of the northern shore of the eastern end of the island. The estimated cost is $10,000.

5. *George's Island.*—This sea-wall was completed about 1835, and was designed for the protection of the site of Fort Warren. It stands, however, in very important relations to the preservation of the main ship-channel. It is 2,150 feet in length. It is in good condition, but needs some repair. The estimated cost is $100. Some of the paving in rear of this wall should be renewed. The estimated cost is $1,200.

A portion of the southeastern shore of the island is protected by an apron of rubble-stone, built during the construction of the fort. This apron is 600 feet in length. It requires additional stone. The estimated cost is $600.

A similar apron, situated at the northern end of the sea-wall next the main ship-channel, requires strengthening and extension. The estimated cost is $800.

6. *Rainsford Island.*—This wall was completed about 1840. It is 1,500 feet in length. It is in poor condition, requiring extensive, repairs and partial reconstruction. Its condition, however, is not at present materially changing. It has therefore been thought best to postpone work upon it until the plant now in use at Lovell's and Gallop's islands is available. It can be undertaken during the spring of next year. The estimated cost is $5,000.

7. *Long Island.*—The sea-wall for the protection of the North Head of this island was completed in 1874. It is 2,081¾ feet in length. Its foundation is protected by a rubble-stone apron, originally 975 feet in length, and ten stone jetties, which were also completed in 1874. During this year the ends of the walls have been protected by aprons.

In addition to its value in the preservation of the harbor, this wall is a protection for the important barbette battery above it. It is in excellent condition.

8. *Deer Island.*—Three sea-walls protect the prominent heads of this island. The one at the North Head is 1,740 feet, that at the Middle Head, 840 feet and that at the South Head 380 feet in length. They are dry walls, the only backing being clay and gravel. They were built under appropriations made in 1827. They were rebuilt, using the old materials, between the years 1865 and 1869. Although these walls are imperfect, and in rather poor condition, extensive repairs are not at present deemed advisable. The moderate repairs recommended are estimated to cost $300.

9. *Castle Island.*—This wall was completed about 1835. It was designed for the protection of the site of Fort Independence. It stands, however, in vers important relations to the main ship-channel. Its length is 3,300 feet. It is generally in good condition, but requires repairs. The estimated cost is $350.

A portion of the southeastern shore is protected by 300 feet of riprap, which is in excellent condition.

A detailed description and history of most of these walls will be found in the Report of the Chief of Engineers for 1876, Part I, page 169.

The total amount required for the repair of these works of preservation is $54,500.

It is proposed to execute all this work during the fiscal year ending June 30, 1884, with funds now on hand.

As regards improvements of the navigable capacity of Boston Harbor, I respectfully submit the following remarks and recommendations.

1.—UPPER HARBOR.

The first plan of improvement submitted by the late Lieut. Col. John G. Foster, Corps of Engineers, in 1867, provided for a channel at the Upper and Lower Middle of a width of 1,000 feet and of a depth of 23 feet at mean low water. For economical reasons, this project has never been fully carried out, a channel width of 600 feet only having been excavated. This channel has been of great benefit, but is now insufficient. The rapid growth of commerce, especially of the heavy export trade, and the change in the size and character of vessels engaged in the ocean traffic, render further improvement necessary.

A channel sufficiently capacious for vessels from 200 to 300 feet long is too contracted for ships of twice that length, especially at its turns and in the vicinity of the wharves of a large seaport. In my opinion, therefore, the width of this channel should be eventually increased to 1,000 feet. The following improvements proposed and recommended in the Upper Harbor are in conformity with this general project:

1. *Removal of the spur of Castle Island Shoal.*—This work has been approved by the Department. It is proposed to remove 32,000 cubic yards by dredging during the present season, with funds now on hand. The estimated cost is $17,600.

2. *Widening of the main ship-channel at the Upper and Lower Middle.*—In conformity with the general project, it is recommended that the channel be widened to a least width of 800 feet. This requires the removal by dredging of 189,900 cubic yards as measured in place, or 253,200 cubic yards as measured in scows. The estimated cost, including contingencies, is $128,000.

The widening of the main ship-channel cannot be economically accomplished unless the contracts for dredging provide for the removal of large quantities, for in this case much lower rates can be obtained. It is therefore very desirable that the full amount recommended be appropriated.

2.—LOWER HARBOR.

1. *Channel between Nick's Mate and the North Head of Long Island.*—It is proposed to dredge a channel 200 feet wide and 12 feet deep, between Nick's Mate and the North Head of Long Island. For this work 20,000 cubic yards of dredging is required. The object of this improvement is to enable vessels of moderate draught to go directly, at all stages of the tide, to and from the anchorage ground south of Fort Warren. This

channel will be constantly employed by such vessels as the steamboats running to Hingham, Downer's Landing, Hull, and Nantasket Beach (which carry crowds of people), the Government steamer running to Fort Warren, the quarantine boat running to Gallop's Island, the light-house tenders, and many tugs and small coasters. The principal benefit derived will be the relief of the Narrows of the main ship-channel, by the diversion therefrom of these smaller vessels.

The estimated cost of this improvement is $9,000. It is proposed to execute the work during the present season, with funds now on hand.

2. *Improvements of the Narrows.*—The channel in this locality was improved by the United States between 1867 and 1877. The general plan consisted in securing a width of 600 feet, with a depth of 23 feet at mean low water, by dredging at the southwest and southeast points of Lovell's Island and at the Cape Cod Shoal and the western end of the Brewster Bar, and by removing the Corwin, Tower, and Channel rocks.

These improvements have materially facilitated navigation through the Narrows. Further improvement, however, is necessary; and this will increase in importance should the deterioration of the channel by shoaling continue at its present rate.

During recent years a marked change has been in progress in the formation of the western end of the Brewster Bar. From an examination made in the summer of 1882, it appears that since 1876, when its western end was cut off for a width of 150 feet, the bar has extended 120 feet in a southwesterly direction, reducing to that extent the width of the main ship-channel. At this point several large European steamers have grounded. Should the growth of the bar continue, the danger will be much increased, especially for sailing vessels. These generally hug the end of the bar closely, in order to have plenty of room when meeting the strong flood-current in the Black Rock Channel, which tends to sweep them upon the eastern point of Gallop's Island or the George's Island *Flats*. Moreover, the changes now in progress will, in the near future, seriously threaten the site of the Narrows light-house.

Shoaling has also been observed near the southwest point of Lovell's Island.

A great source of danger and inconvenience exists in the flats south of the main wharf of Lovell's Island, which project into the main ship-channel about 100 feet beyond the general direction of the 23-foot contour. Upon these, vessels are frequently swept by the strong ebb-current, a branch of the ebb which sets through the passage between Gallop's and George's islands, and is deflected from its oblique course across the main ship-channel by the southeast point of Lovell's Island. The rocky character of the flats renders the danger still more serious.

In the first project for dredging in this part of the channel, the removal of this projection was included; but the excavation was suspended when the existence of rock was discovered.

Before the preparation of a project for the further improvement of the main ship channel at the Narrows, careful investigation and study is necessary. This is specially the case as regards cutting off the supply of the material for the further extension of Brewster Bar. For this purpose a survey of the Brewster Bar and its slopes, and a resurvey of some portions of the Narrows, are required, and the directions and velocities of currents should be observed. These surveys will in the near future, be further useful in ascertaining the effect upon the Narrows of the sewage matter which the city of Boston proposes to discharge into the harbor at Moon Head. Their execution is recom-

mended. Their cost, including the necessary drawings and projects, is estimated at $1,000.

A drawing showing the general location of the works of preservation and improvement, completed and projected, is herewith transmitted.

RECAPITULATION.

Amount available, exclusive of outstanding liabilities July 1, 1883.....		$82,129 69
To be expended as follows, during the fiscal year ending June 30, 1884, viz:		
Repairs on sea-walls (works of preservation).....	$54,500 00	
Dredging channel between Nick's Mate and the North Head of Long Island.....	9,000 00	
Removal of spur at Castle Island Shoals.....	17,600 00	
Incidental contingencies.....	1,029 69	
		82,129 69
Widening the main ship-channel at the Upper and Lower Middle.....		128,000
Survey of Brewster Bar, and resurvey of portions of the Narrows.....		1,000
Total.....		129,000

Amount that can be profitably expended during the fiscal year ending June 30, 1885, $129,000.

II.—MYSTIC RIVER.

Under contract dated June 14, 1881, with the Eastern Dredging Company, of Portland, Me., for dredging at the mouth of Mystic River, during the fiscal year ending June 30, 1883, 33,490 cubic yards of material have been removed, making an aggregate of 82,020 cubic yards of dredgings removed under this contract, resulting in securing a channel 23 feet deep at mean low water, or 33 feet deep at mean high water, 2,930 feet in length, with a minimum width of 375 feet.

III.—CHARLES RIVER.

The contract with the Eastern Dredging Company, of Portland, Me., dated June 14, 1881, for the removal of 100,000 cubic yards of dredgings was annulled by the Department July 22, 1882, the contractors having abandoned the work after the removal of 12,500 cubic yards of material.

Proposals were subsequently invited by my predecessor, on two separate occasions, for the completion of this work, but on each occasion all bids were rejected, the prices being deemed excessive. Proposals were also invited by my predecessor, August 31, 1882, for dredging from Market Street Bridge to Watertown Bridge, and all bids for this work were rejected, prices being deemed excessive.

After public advertisement, a contract, dated May 22, 1883, was entered into with Mr. John McDermott, of Cohoes, N. Y., for dredging in Charles River, from a point near Stickney's Wharf, above Western Avenue Bridge, up to Brighton Abattoir Wharf, for 39 cents per cubic yard, measured in scows.

Owing to the total loss of the contractor's dredge, on the coast of Long Island, in a gale of wind, work did not begin until June 30, 1883.

A close resurvey of the river (for dredging *in situ*) from Brighton Street Bridge up to Watertown has also been made.

To complete the improvement under the existing project, $67,500 are required, according to the original estimate, but at present rates $116,000 will be required. Of this amount $50,000 could be expended during the fiscal year ending June 30, 1885.

RECAPITULATION.

Amount available July 1, 1883, exclusive of outstanding liabilities	$28,672 32
To be expended during the fiscal year ending June 30, 1884 (now under contract)	28,672 32
Amount required to complete project, say	116,000 00

IV.—NANTASKET BEACH CHANNEL.

Under contract with Mr. George W. Townsend, of Boston, Mass., dated September 28, 1882, 50 cubic yards of sunken ledge have been broken up and removed from the channel, and the contract completed.

The following is a recapitulation of the estimates for the prosecution of the several works projected for the improvement of Boston Harbor, to wit:

To be expended during the fiscal year ending June 30, 1884:		
Amount available July 1, 1883, exclusive of outstanding liabilities		$110,802 01
Repairs on sea-walls (works of preservation)	$54,500 00	
Dredging channel between Nick's Mate and the North Head of Long Island	9,000 00	
Removal of the spur at Castle Island Shoal	17,600 00	
Incidental contingencies	1,029 69	
Dredging in Charles River, now under contract	28,672 32	
		110,802 01

Amounts projected for:	
1. Widening the main ship channel at the Upper and Lower Middle	$128,000
2. Survey of Brewster Bar, and re-survey of portions of the Narrows	1,000
3. Continuing the Charles River improvement	116,000
Total	245,000

Amount that can be expended in fiscal year ending June 30, 1885, viz:	
Boston Harbor proper	$129,000
Continuing the improvement of Charles River	50,000
Total	179,000

The several works completed and projected for the improvement of this harbor are located in the collection district of Boston and Charlestown. Boston is the port of entry.

The accompanying commercial statistics for the fiscal year ending June 30, 1883, have been furnished by the United States collector of customs.

Money statement.

July 1, 1882, amount available		$68,662 63
Amount appropriated by act passed August 2, 1882		96,500 00
		165,162 63
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$46,318 50	
July 1, 1883, outstanding liabilities	8,042 12	
		54,360 62
July 1, 1883, amount available		110,802 01
Amount (estimated) required for completion of existing project		245,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		179,000 00

Abstract of proposals received and opened September 15, 1882, *by Col. George Thom, Corps of Engineers, for improving harbor at Boston, Mass.*

No.	Names of bidders.	Residence.	Removal of the sunken ledge in Nantasket Beach Channel, leading from Boston Harbor, Mass. About 50 cubic yards, measured *in situ*.
			Per cubic yard.
1	George W. Townsend	Boston, Mass	$35 00
2	Isaac Hamilton and Gardner Floyd	Portland, Me	50 00

Contract with George W. Townsend, of Boston, Mass.; dated September 28, 1882, and expiring April 1, 1883.

Abstract of proposals for dredging in Charles River, Massachusetts, received in response to advertisement dated April 30, 1883, *and opened May* 21, 1883, *by Maj. Charles W. Raymond, Corps of Engineers.*

No.	Names of bidders.	Residence.	Price, measured *in situ*.	Price, measured in scows.
			Per cu. yd.	*Per cu. yd.*
1	John McDermott	Cohoes, N. Y	$0 68	$0 39
2	Augustus P. Martin	Boston, Mass	.....	97½

Contract with John McDermott, of Cohoes, N. Y.; dated May 22, 1883, and expiring September 30, 1883, for dredging in Charles River, Massachusetts, from a point near Stickney's Wharf, up to Brighton Abattoir Wharf, at 39 cents per cubic yard, measured in scows.

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, BOSTON, MASS.,
Collector's Office, July 21, 1883.

SIR: With further reference to your letter of the 12th ultimo, and in compliance with the request made therein, I have to inform you:

1. Customs collections from all sources at this office, during the fiscal year ending June 30, 1883, were	$23,476,439 95
Included in above are hospital dues amounting to	17,407 16
2. Vessels arrived from foreign ports, number 2,946, tonnage, 1,343,870. Vessels cleared for foreign ports, number 2,849, tonnage, 1,162,273.	
3. Value of merchandise imported during the year ending June 30, 1883	72,552,075 00
4. Value of merchandise exported during the year ending June 30, 1883	62,356,974 00

Vessels engaged in the coastwise trade are not obliged to enter and clear at this office, only in exceptional cases, and therefore I cannot supply you with any statistics relating thereto that would be of practical value.

No separate record is kept of the value of merchandise discharged at Malden.

Yours, respectfully,

R. WORTHINGTON,
Collector.

Maj. CHAS. W. RAYMOND,
Corps of Engineers, U. S. A.

BOSTON HARBOR, MASS.

SKETCH SHOWING

LOCATIONS OF WORKS FOR ITS IMPROVEMENT,

viz:

At a, *Sea wall on Point Allerton 1202 feet long, built in 1870–78.*
" b, *Nash's Rock Shoal, removed to a depth of 20½ feet at Mean Low Water in 1876–78.*
" c, *Sea wall at Great Brewster, 2440 feet long, built in 1849–69.*
" d, *Kelly's Rock & the Ledges near it, removed to a depth of 23 feet at M.L.W. in 1869–79.*
" e, *Tower & Corwin Rocks removed to a depth of 23 feet at M.L.W. in 1867–69.*
" f, *West End of Brewster Spit, dredged, and sunken ledge removed to a depth of 23 feet at M.L.W. in 1874–76.*
" g, *Channel Rock in Narrows removed to a depth of 23 feet at M.L.W. in 1874.*
" h, *S.E. Point of Lovell's Is^d dredged to a depth of 23 feet at M.L.W. in 1874–75.*
" i, *S.W. Point of Lovell's Is^d, and Cape Cod Shoal, dredged to a depth of 23 feet at M.L.W. in 1867–77.*
" j, *Shoal between Long Is^d and Nix's Mate. Dredging projected for a channel of a width of 200 feet and a depth of 12 feet at M.L.W.*
" k,k, *Sea walls on Lovell's Island of a total length of 1550 feet, built in 1843–79.*
" K,K, *Aprons and jetties of rubble stone commenced in 1883.*
" l, *Sea wall on Gallop. Is^d, 1745 ft. long, built in 1868–71.*
" L, *Apron and jetties of rubble stone commenced in 1883.*
" m, *Barrel Rock in Broad Sound removed in 1869.*
" n, *Sea wall on Long Island, 2032 feet long, built in 1870–74.*
" n',n', *Apron and jetties of rubble stone at ends of sea wall at Long Is^d built in 1881–82.*
" o, *Sea wall on Rainsford Island, 1500 feet long, built about 1840.*
" p,p,p, *Sea walls on Deer Island of a total length of 3000 feet, built in 1825–69.*
" q, *Castle Is^d Bar, abreast of Lower Middle, dredged, for widening channel, in 1880.*
" r, *Slate and Palmyra Rocks, removed in 1874–75.*
" s, *Upper Middle Bar, dredged, and sunken rocks removed to a depth of 23 feet at M.L.W., and to a width of 600 feet in 1870–1878.*
" t, *Anchorage Shoal, dredged to a depth of 23 feet at M.L.W. in 1879–'82.*
" u, *Man of War Shoal, dredged to a depth of 23 feet at M.L.W. in 1879–'80.*
" V, *Mystic River Shoal, dredged to a depth of 23 feet at M.L.W., and to a minimum width of 375 feet, in 1879–'82.*
" W, *Charles River, dredged to a depth of 7 feet at M.L.W., and a width of 200 feet, in 1880–'81.*
" X,X, *Upper Middle & Spur of Castle Is^d Shoal, dredging projected for widening channel from 600 feet to 1000 feet at a depth of 23 feet at M.L.W.*
" Y, *Hingham Harbor, a channel dredged, and sunken rocks removed to a depth of 8 feet at M.L.W. in 1875–76.*
" Z,Z, *Nantasket Channel, dredged to depth of 9½ feet at M.L.W. and to a minimum width of 100 feet, in 1881–'82.*

Note. The above described Improvements belong to the period extending from the year 1825 to June 30 1883.
The soundings are expressed in feet and referred to the plane of Mean Low Water.
The Mean Rise and Fall of Tides is at Charlestown Navy Yard . . . . . 9.8 Feet.
" " " " " " " " " Boston light . . . . . 9.4 " .

Scale of 1 : 80000.

To accompany report of Major Chas. W. Raymond, U.S. Engineers, for fiscal year ending June 30. 1883, dated U.S. Engineer Office, Boston, Mass. July 27. 1883.

B 5.

IMPROVEMENT OF PLYMOUTH HARBOR, MASSACHUSETTS.

The charge of this work was transferred to me by Lieut. Col. George H. Elliot, Corps of Engineers, April 6, 1883, in compliance with directions of the Chief of Engineers, dated April 4, 1883.

The present project for the improvement of this harbor was adopted in 1866, and modified in 1875 and 1882, the object being:

1. The protection and preservation of Long Beach (this harbor's only protection from easterly storms), which of late years has been washed away in places, seriously threatening the ruin of the harbor.

2. The opening a channel of navigable width, with a depth of not less than 16 feet at mean high water, from the natural channel to the dredged basin in front of the wharves at Plymouth.

For the protection and preservation of Long Beach various works have been built, consisting of bulkheads, jetties, crib-piers, and groins, resulting in its restoration in part by the accumulation of sand and growth of beach-grass. A full history of these works will be found in the annual report of the Chief of Engineers of June 30, 1877.

From 1866 to 1883 there has been allotted and appropriated by Congress $98,800, as follows:

Amount allotted in 1866 from appropriations made July 2, 1864, for harbors on the Atlantic coast	$8,300
Amount allotted under act of July 25, 1868	7,500
By river and harbor act of July 11, 1870	10,000
By river and harbor act of March 3, 1871	10,000
By river and harbor act of June 10, 1872	2,500
By river and harbor act of March 3, 1873	3,000
By river and harbor act of June 23, 1874	5,000
By river and harbor act of March 3, 1875	5,000
By river and harbor act of June 18, 1878	3,500
By river and harbor act of March 3, 1879	10,000
By river and harbor act of June 14, 1880	10,000
By river and harbor act of March 3, 1881	10,000
By river and harbor act of August 2, 1882	14,000
Total	98,800

By aid of these appropriations the projects of 1866 and 1875 were reported as completed June 30, 1882, during which year $14,830.03 were expended.

In furtherance of the modified project of 1882, the following work has been done during the fiscal year ending June 30, 1883, to wit:

Contract was entered into September 20, 1882, with Mr. Charles H. Edwards, of Quincy, Mass., for furnishing and putting in place rubble-stone in extension of the bulkhead along the western shore of the beach, this being its weakest part. Under this contract 5,006 tons of stone have been placed, extending the bulkhead for a length of 830 feet, making a total length of 1,700 feet.

In addition to this, by hired labor and purchased material, the old part of this bulkhead has been backed with cedar trees and small stone, to render it sand-tight, for a length of 640 feet. A catch-sand fence of cedar trees and stone has been built parallel to and 15 feet east of the old triangular bulkhead which forms the backbone of the old works for a length of 730 feet. A leak north of the old crib-work has also been stopped by backing 60 feet of the stone bulkhead with trees and small stone.

The work of protecting Long Beach has, since 1870, been mainly confined to the restoration of its northern extremity, within 2,000 feet of the

beacon, and has resulted in the reformation along this stretch of beach of about 171,000 cubic yards of sand, at an estimated cost of about $54,000, the growth being wholly due to this work.

The remaining 2½ miles of beach, which previous to 1870 had been protected by triangular plank bulkheads, have since then suffered greatly from wind and wave action, notably in the gale of January 10, 1883, rendering necessary the rebuilding of about 5,000 linear feet of the crest. It is proposed to accomplish this by the construction of a plank sand-barrier, faced with brush and stone, the estimated cost of which is as follows:

I.	For protection of lower (southerly) end of Long Beach, 5,000 linear feet of plank sand-barrier faced wi h brush and stone, at $3.60 per linear foot, including contingencies	$18,000
II.	For probable repairs to work on northern extremity of the beach	1,000
	Total	19,000

This amount, if appropriated, can be profitably expended during the fiscal year ending June 30, 1885.

This work is located in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) lights, about 5 miles from the city of Plymouth, and Duxbury pier light, distant about 2 miles.

Money statement.

July 1, 1882, amount available		$89 67
Amount appropriated by act passed August 2, 1882		14,000 00
		14,089 67
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		12,968 53
July 1, 1883, amount available		1,121 14
Amount (estimated) required for completion of existing project		19,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		19,000 00

Abstract of proposals received and opened September 15, 1882, by Col. George Thom, Corps of Engineers, for improving harbor at Plymouth, Mass.

No.	Names of bidders.	Residence.	About 6,000 tons of rubble-stone.	
			5,000 tons of large stone, per ton of 2,240 pounds.	1,000 tons of small stone, per ton of 2,240 pounds.
1	Charles H. Edwards	Quincy, Mass	$1 97	*$1 70
2	Joseph H. White	Hyde Park, Mass	2 19	2 19
3	Mount Waldo Granite Works, John T. Rowe, president.	Frankfort, Me	2 50	2 50

* Or $1.50 if landed on the beach.

ABSTRACT OF CONTRACT FOR IMPROVING HARBOR AT PLYMOUTH, MASSACHUSETTS, DURING THE FISCAL YEAR ENDING JUNE 30, 1883, BY COLONEL GEORGE THOM, CORPS OF ENGINEERS.

Contract with Charles H. Edwards, of Quincy, Mass., dated September 20, 1882, and expiring December 31, 1882, for furnishing and putting in place rubble-stone in bulkhead on Long Beach, as follows:

1. Granite quarry grout (large stone), for $1.97 per ton of 2,240 pounds.
2. Rounded bowlders and small quarry fragments, for $1.70 per ton of 2,240 pounds.
3. Small stone, if landed on the beach, for $1.50 per ton of 2,240 pounds.

COMMERCIAL STATISTICS OF PLYMOUTH HARBOR, MASSACHUSETTS, FOR THE FISCAL YEAR ENDING JUNE 30, 1883, FURNISHED BY THE COLLECTOR OF CUSTOMS.

Amount of revenue collected	$70,549 33

FOREIGN ENTRANCES AND CLEARANCES.

Number	50
Tonnage	32,981

FOREIGN IMPORTS AND EXPORTS.

			Value.
Imports:			
Hemp	tons	1,635	$302,795
Iron rivet-rods	do	909	35,935
Coal			2,866
Fish (800 quintals)	tons	40	1,575
Total imports			343,171
Exports:			
Cordage	pounds	92,524	9,094
Merchandise now in bond:			
Iron rivet-rods	tons	833	33,158
Total value of imports and exports			385,423

DOMESTIC IMPORTS AND EXPORTS.

			Cargoes.
Imports:			
Coal	tons	18,150	83
Hay	do	265	4
Fish (2,430 quintals)	do	150	3
Iron	do	2,102	18
Lumber (4,338,845 feet)	do	2,000	21
Granite	do	200	2
Tar (2,400 barrels)	do	240	2
Salt	do	225	7
Miscellaneous, by steamers and packets (estimated)	do	1,200	..
Total imports	do	35,332	140
Exports:			
Nails	tons	250	5
Wood	do	1,200	20
Barrels	do	224	28
Miscellaneous, by steamer and packet (estimated)	do	1,000	..
Total exports	do	2,674	53
Total imports and exports	do	38,006	193

Value, imports and exports, $993,362.

RECAPITULATION.

Value of foreign imports and exports	$352,265
Value of domestic imports and exports	993,362
Total	1,345,627
Number of cargoes, foreign and domestic	243
Number of tons merchandise	38,006
Number of arrivals and departure of vessels	2,643
Number of passengers arriving and departing by water	28,184

B 6.

IMPROVEMENT OF PROVINCETOWN HARBOR, MASSACHUSETTS.

The charge of this harbor was transferred to me by Lieut. Col. George H. Elliot, Corps of Engineers, U. S. A., in compliance with instructions of the Chief of Engineers dated April 4, 1883.

This harbor is situated at the extremity of Cape Cod. It is one of the most important harbors of refuge on the Atlantic coast; the entire commerce of New England being directly benefited by its maintenance. In addition to this it accommodates a large fleet of fishing vessels engaged in its principal local commerce. It is easy of access and completely protected, furnishing safe anchorage for every class of vessels navigating the ocean. Its maintenance, however, depends entirely upon the beaches inclosing it.

The project for its improvement was adopted in 1866, and modified in 1869, 1872, and 1873. It consists in the construction of bulkheads of wood and stone, jetties of wood and brush, dikes, catch sand fences, and the extensive planting of beach-grass, the object being the preservation of the inclosing beaches. A full history of these improvements will be found in the Annual Reports of the Chief of Engineers of 1876 and 1879.

Since the resumption of work in 1866 $111,568.44 have been appropriated and allotted by Congress to this harbor. By aid of these funds all the projected works were reported completed by the officer in charge June 30, 1882, with the exception of the stone bulkhead on the eastern end of Long Point, at a total cost of $105,012.07.

Of this sum $3,430.72 was expended in the fiscal year ending June 30, 1882, in strengthening the stone bulkhead on Long Point.

During the fiscal year ending June 30, 1883, operations have been continued as follows:

Under contract with Mr. Joseph H. White, of Hyde Park, Mass., dated May 3, 1882, $540\frac{400}{2240}$ tons of stone were placed on the bulkhead of the outer side of Long Point near its eastern end.

Proposals were received September 15, 1882, for continuing the improvement, but all bids were rejected, they being deemed too high.

Proposals were invited by circular letter dated October 12, 1882, for the same work, and the contract was awarded to Mr. Charles H. Edwards, of Quincy, Mass, but owing to the lateness of the season and the severity of the autumnal and winter storms, he was unable to accomplish anything, and was released from his agreement.

Proposals were invited by public advertisement, and opened March 20, 1883, for furnishing and delivering stone and brush at Long Point, and contract was entered into with Mr. Joseph H. White, of Hyde Park, Mass., dated March 20, 1883, he being the lowest bidder. Under this contract work was commenced in the month of April, and $1,085\frac{1600}{2240}$ tons of stone have been put in place, extending the bulkhead for a length of 367 feet.

The present condition of the works of improvement and preservation in this harbor, and the additional work now required, as determined from an examination made under my orders by Mr. Sophus Haagensen, assistant engineer, are as follows. (See map in Report of the Chief of Engineers for 1876, Part I, page 188.)

Long Point.—Although the existing stone groins have collected some sand, they cannot be expected to arrest more, since their elevation is small, especially as the stone breakwater is very open and allows the

sand to escape through it. The breakwater should be backed with brush and small stone, a protection which has been successful at Plymouth, and doubtless would be here. Such a backing would, in a short time, probably make the beach solid from the crest to the top of the breakwater. Its cost is estimated at $4,400.

Beach Point is in excellent condition. The jetties are all sanded up, and the beach-grass looks fine.

High Head Dike is in fine condition, and needs no repair.

Cove Section.—Since 1875, the year of Mr. Haagensen's last inspection, remarkable changes have taken place for the better. The old bulkhead and jetties and the stone monuments are almost entirely buried in sand. The crest has apparently increased in height. The high-water line has moved seaward.

Dike at Abel Hill.—The dike is generally in fine condition, but where it joins the outer beach teams have crossed, tearing up the beach-grass and leaving the sand exposed to the wind. There is, at this point, a depression 5 feet lower than the top of the dike. This should be filled and sodded over, and a substantial fence should be placed in the axis of the dike to prevent travel on the inner side of the beach. The cost of this work is estimated at $560.

House Point Island Flats.—Great changes have occurred in this part of the harbor. The reports of wharf owners and others that the flats have encroached upon the harbor are confirmed. Formerly sand was moved by the tide from the outside through Lancy's Harbor, but this main source of supply was cut off by the construction of Abel Hill Dike. Since then the neighboring hills (Gull Hill, Steven's Point, &c.,) have been much denuded of beach-grass and shrubbery. Sand blows constantly upon the flats and is carried into the harbor by the receding tide. Wave action has destroyed the street in front of Stevens Point Hill, necessitating the removal of houses and stores and the erection by the town of a costly timber bulkhead for its new street.

The sand accumulates principally upon the flats to the westward of a line joining Stevens and Lobster Points. Its movement into the harbor can probably be prevented by nothing less than a substantial dike extending between the two points. Such a work, however, cannot be recommended, designed, or estimated for without further and elaborate study. For this purpose the hydrographic survey of 1873 should be now repeated. Its estimated cost is $900.

The facts reported by Mr. Haagensen, upon which the above recommendations are based, have been largely verified by my own personal observation. The very remarkable success of the works of improvement in this harbor and the experience gained in the treatment of its peculiarities seem to justify further expenditures. I therefore recommend the following appropriations, which can be profitably expended during the fiscal year ending June 30, 1885, viz:

1. Long Point, backing breakwater	$4,400
2. Abel Hill Dike, repairing beach	560
3. Hydrographic resurvey of harbor	900
Total	5,860

Provincetown is a port of entry in the collection district of Barnstable, Mass. The nearest light-houses are Long Point and Wood End lights.

The accompanying letter of the deputy collector at the port of Provincetown furnishes the commercial statistics for the fiscal year ending June 30, 1883.

Money statement.

July 1, 1882, amount available		$1,556 35
Amount appropriated by act passed August 2, 1882		5,000 00
		6,556 35
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$2,920 86	
July 1, 1883, outstanding liabilities	74 88	
		2,995 74
July 1, 1883, amount available		3,560 61
Amount (estimated) required for completion of existing project		5,860 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		5,860 00

Abstract of proposals received and opened March 20, 1883, by Maj. Franklin Harwood, Corps of Engineers, for improving harbor at Provincetown, Mass.

No.	Names of bidders.	Residence.	About 1,528 tons of stone.		About 500 trees.	
			444 tons of small stone, per ton of 2,240 pounds.	1,084 tons of large stone, per ton of 2,240 pounds.	500 cedar trees, per tree.	500 other evergreen trees, per tree.
1	Joseph H. White	Hyde Park, Mass	$2 14½	$2 14½	$1 22	$1 00
2	John G. Thompson	North Truro, Mass	2 23	2 23	1 23	93
3	Rowe & Sylvester	Boston, Mass	2 24	2 24	1 20	.....

Contract with Joseph H. White, of Hyde Park, Mass.; dated March 20, 1883, for furnishing and delivering in place stone and brush for beach protection at Long Point.

COMMERCIAL STATISTICS.

DEPUTY COLLECTOR'S OFFICE,
Port of Provincetown, July 3, 1883.

SIR: In answer to your inquiries I have the honor to forward the following answers:

The amount of revenue collected at this office for the year designated was $1,734.29.

The number of foreign entrances was 25, having a tonnage of 2,385 tons; of foreign clearances, 24, having a tonnage of 2,076 tons.

The value of merchandise imported into this port was $74,143.13.

The number of arrivals and departures of vessels to and from this port was 7,558.

The estimated value of commerce and navigation that has entered Princetown Harbor for shelter and protection for the year ending June 30, 1883, is $22,000,000.

Respectfully,

JAMES GIFFORD,
Deputy Collector.

F. B. Goss, Esq.,
Collector of Customs, Barnstable.

B 7.

IMPROVEMENT OF LYNN HARBOR, MASSACHUSETTS.

The charge of this harbor was transferred to me by Col. George Thom, Corps of Engineers, January 18, 1883, in compliance with Special Order No. 1, Headquarters of the Army, Adjutant-General's Office, Washington, January 2, 1883.

On December 31, 1881, my predecessor submitted a report upon the survey of this harbor accompanied with a project for its improvement.

This report appears in full in the Annual Report of the Chief of Engineers of 1882, Part I, page 544.

The project was referred by the Chief of Engineers to the Board of Engineers for Fortifications and for River and Harbor Improvements "for consideration, and for its views and recommendations."

The Board, after considering the subject, deemed it advisable to obtain further information "from observation of the flow of tides and the strength of the currents in this harbor. The distribution of the flood through the channels and the velocities during the period between low-water and the time of submergence of the shoals will probably be of importance in determining the nature and position of works of improvement, and similar observations of the outflow of the tides are likewise needed."

In compliance with orders received from the Chief of Engineers, a party has been employed in procuring the desired information, and at the close of the fiscal year ending June 30, 1883, the work is well advanced towards completion.

This work has been under the direct charge of Mr. H. F. Bothfeld, assistant engineer. The final report will be submitted at an early day.

Lynn is a port of entry in the Marblehead collection district. The nearest lighthouse is Egg Rock (Nahant) light, distant about 3 miles.

The accompanying letters from the collector of customs and the mayor of Lynn furnish the commercial statistics for the fiscal year ending June 30, 1883.

Money statement.

Amount appropriated by act passed August 2, 1882	$60,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	2,138 07
July 1, 1883, amount available	57,861 93
Amount (estimated) required for completion of existing project	210,000 00

COMMERCIAL STATISTICS.

LETTER OF COLLECTOR OF CUSTOMS AT MARBLEHEAD, MASSACHUSETTS.

CUSTOM-HOUSE, MARBLEHEAD, MASS.,
Collector's Office, July 3, 1883.

SIR: I have the honor to acknowledge the receipt of your favor of June 12, requesting statistics of the commerce, &c., of Lynn, and ports situated upon Lynn Harbor. Herewith I transmit the statistics required, as follows, viz:

CUSTOMS REVENUE FOR LYNN AND PORTS ON LYNN HARBOR.

Number of vessels arrived, 589; departed, 589; foreign, 39; domestic, 550; tonnage, 96,000. Total tonnage, 99,569.

DESCRIPTION AND VALUATION OF CARGOES OF SAME.

	Value.
Coal, 102,000 tons	$612,000
Lumber	150,000
Firewood	7,000
Lime, 23,000 casks	23,000
Cement, 7,000 casks	10,500
Bricks, 100,000	9,000
Sand	9,000
Piping, tiling, and miscellaneous	6,500
Total	827,000

I am, very respectfully,

SIMEON DODGE,
Collector.

LETTER OF MAYOR OF LYNN, MASSACHUSETTS.

MAYOR'S OFFICE,
Lynn, Mass., July 12, 1883.

SIR: With as little delay as possible I forward such a statement, in reply to your request under date of June 11, 1883, as I have been able to have prepared.

There is no "Board of Trade" in the city of Lynn, but the figures which are herewith presented have been made up by as reliable authorities as could be consulted:

Present population of the city of Lynn (estimate)	43,000
Present population of adjoining towns, dependent with the city upon Lynn Harbor for certain supplies (estimate)	10,000
Number of vessels arriving from and departing for domestic ports	550
Gross tonnage of the same	96,000
	Value.
Coal landed, 102,000 tons	$612,000
Lumber landed	150,000
Firewood landed	7,000
Lime landed, 23,000 barrels	23,000
Cement landed, 7,000 barrels	10,500
Stone landed	15,000
Bricks landed	9,000
Sand landed	9,000
Miscellaneous, hay, tiles, pipes, &c	6,500
Total value of merchandise landed from domestic vessels	842,000
Number of foreign vessels arriving	39
Tonnage of the same	3,569
Value of merchandise received thereby	$10,222 08
Amount of duties received thereon	2,670 38

The number of vessels arriving and the value of merchandise brought to Lynn by way of its harbor fluctuates considerably, and this is principally caused by the changing character of the trade in lumber, bricks, and other building materials.

BUSINESS AT LYNN RAILROAD FREIGHT YARD.

Loaded cars arriving daily	45
Tons of freight received by the same	200
Loaded cars dispatched daily	20
Tons of freight forwarded	85

It should be noted that the value of merchandise, especially that which is sent away, is very great when compared with its weight and bulk.

MANUFACTURES.

Number of manufacturing establishments for the manufacture of shoes and finished leather	600
Estimated number of employés	10,000
Estimated active capital employed	$13,000,000
Estimated business in shoes and leather alone	35,000,000

The great standard business of the city is constantly increasing.

In the manufacture of ladies' shoes, Lynn holds the first rank in the Union, and probably in the world. In the manufacture of light upper leather adapted to ladies' shoes, she has the first rank in New England, and is second in the United States.

The general and miscellaneous business of the city, that is, those branches of trade engaged in supplying the daily demands of an active and prosperous community of more than 50,000 people, is fully of average volume.

There are many business interests which, while they are of recent origin, and bear no comparison in importance with the shoe and leather manufacture, are very prosperous and promise well for the future; principal among these is the production of machinery.

The signs of Lynn's continuing growth in business and population are unmistakable. The necessity for the improvement of the harbor becomes more pressing and urgent every year. Our citizens have regarded this work as begun by the appropriation of

the Forty-seventh Congress, which was obtained by long-continued and earnest effort, and they trust that it will be prosecuted with speed and vigor.

For a full statement of many facts, arguments, and reasons in this direction, permit me to refer to the petition in behalf of the city of Lynn by one of my predecessors, a copy of which accompanies this communication.

Very respectfully, yours,

WILLIAM L. BAIRD,
Mayor.

CHARLES W. RAYMOND,
Major of Engineers, U. S. A.

[House Mis. Doc. No. 6, Forty-sixth Congress, third session.]

IMPROVEMENT OF LYNN HARBOR, MASSACHUSETTS.

Petition in relation to the improvement of the harbor of Lynn, Massachusetts.

DECEMBER 10, 1880.—Referred to the Committee on Commerce and ordered to be printed.

To the honorable the Senate and House of Representatives of the United States in Congress assembled:

The city of Lynn, in the county of Essex, and commonwealth of Massachusetts, hereby presents its memorial, setting forth its need as a seaport, and for the purpose of maintaining its prosperity under the changing conditions of commerce, of the aid of the General Government in improving its harbor.

The city of Lynn has a population of nearly 40,000 inhabitants, and is the center o an industry of great importance, the shoe manufacture, whose products are sold in all the markets of the land. It has over six hundred manufacturing establishments, giving employment to between eight and ten thousand operatives, activity to a productive capital of at least thirteen millions, and doing a business annually of thirty-five millions of dollars. The proper maintenance of a harbor, on whose shores so large and flourishing a business has grown up, has a vital relation to the prosperity and growth of this community, and is a subject of national as well as of local interest. The obvious advantages of a seaport in close proximity to manufactories lies in the saving effected in the transportation of the raw materials that enter into the manufactured products, of the lumber, iron, stone, brick, lime, and cement used for building purposes as population increases and business is extended, and in the transportation of coal that supplies fuel and the motive-power of machinery. A frontage upon the sea useful for commerce greatly lessens the cost of production while increasing the purchasing value of wages. This advantage the people of Lynn have heretofore enjoyed as far as the shallow waters of its harbor, navigable only for vessels of light draught, permitted. But even this advantage, entirely inadequate to the present necessities of the case, is gradually disappearing, as vessels of a draught too deep for the water of Lynn Harbor are coming into general use for carrying such freights as the business of Lynn requires should be landed at its wharves. The consequence must be that the merchants and manufacturers of Lynn must land their water-borne freights at other ports than their own, probably at Boston, some 10 miles away.

Your memorialist believes that the General Government will not permit the commerce of a port that is intimately connected with these large business interests to perish or suffer in consequence of one natural defect, if it can be saved by an improvement of the harbor at an expense not disproportioned to the end to be attained. The excavation of a channel in Lynn Harbor adequate to the shipping employed in the coasting trade, and such work as would be necessary for the maintenance of the channel, would insure to the city of Lynn and the country the continuance, and, it is believed, the enlargement, of the commercial opportunities heretofore enjoyed at this port.

The harbor is free from rocks and obstructions of every kind. Its bottom is a bed of sand about 10 feet deep, resting on a formation of clay; it lies under the shelter from the east of the peninsula of Nahant, and of Long Beach, connecting Nahant with the main land. In its outer roadstead vessels may ride safely at anchor while waiting for the tide, except in southeast gales, which, however, are rare on this coast and of short duration. It has a safe and easy approach to the sea. It is in area about 12,000 feet square, and has a water frontage of some 30,000 feet, on which are eighteen wharves, heretofore visited annually by about a thousand vessels, receiving freights to three-quarters of a million dollars in value, and among them nearly 100,000 tons of coal.

In the opinion of competent engineers the waters of inlets tributary to the harbor could be made available to produce a scour sufficient to keep open any channel that

should once be excavated. It is believed that the expense of the improvement would be small in comparison with the advantages to be gained. The harbor belongs to the commerce of the country, and the appeal is to the country to do what the necessities of commerce require, and the exigency for action is pressing.

Wherefore your memorialist, acting in behalf of the people of Lynn, who are most earnestly urgent for the relief sought, prays that Congress will early take measures for making the harbor of Lynn convenient for commerce in the manner herein proposed, and in such other way as in its wisdom shall seem fit.

In testimony whereof the city of Lynn has caused its seal to be hereto affixed, and these presents to be signed in its name, this 6th day of December, A. D. 1880, by George P. Sanderson, its mayor, thereunto duly authorized by a vote of the city council of said city of Lynn.

CITY OF LYNN,
[SEAL.] By GEO. P. SANDERSON,
Mayor.

B 8.

IMPROVEMENT OF MALDEN RIVER, MASSACHUSETTS.

The charge of this work was transferred to me by Col. George Thom, Corps of Engineers, January 18, 1883, in compliance with Special Order No. 1, Headquarters of the Army, Adjutant-General's Office, Washington, January 2, 1883.

This river is tributary to Mystic River, into which it empties 3 miles above its mouth, at the navy-yard in Boston Harbor, Massachusetts.

A survey was made in 1880 with a view to the improvement of the river from its mouth up to the second bridge in Malden. This survey showed a navigable depth of barely 7 feet at mean high water, the mean rise and fall of the tide being 9.8 feet.

The project adopted for its improvement consists in making a channel following the natural bed of the river, so as to have a depth of 12 feet at mean high water, and width of 100 feet up to the draw-bridge in Malden, and thence a width of 75 feet, up to the second draw-bridge near the rubber works; at an estimated cost of $35,000.

By the river and harbor act of August 2, 1882, $10,000 was appropriated in furtherance of this improvement. On August 31, 1882, proposals were invited for dredging the channel, and bids were opened September 15, 1882, but were all rejected, being deemed too high. Proposals were again invited by public advertisement April 30, 1883, and a contract entered into with Mr. Robert Hamilton, jr., of Cumberland, Me., dated May 23, 1883, for straightening, widening, and deepening the channel below the Malden River draw-bridge.

Under this contract work was begun June 5, 1883, and at the close of the fiscal year 4,420½ cubic yards of material had been removed, resulting in making a channel 1,200 feet in length, 30 feet in width, and 12 feet deep at mean high water.

To complete the improvement under the existing project $25,000 are required (according to the original estimate), but at present rates $37,000 will be required, all of which can be profitably expended during the fiscal year ending June 30, 1885.

This work is located in the collection district of Boston. The nearest port of entry is Boston, Mass. The nearest light-house is Long Island Head-light in Boston Harbor.

Money statement.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$1,202 33	
July 1, 1883, outstanding liabilities	108 30	
		1,310 63
July 1, 1883, amount available		8,689 37
Amount (estimated) required for completion of existing project		37,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		37,000 00

Abstract of proposals for dredging in Malden River, Massachusetts, received in response to advertisement dated April 30, 1883, and opened May 21, 1883, by Maj. Charles W. Raymond, Corps of Engineers.

No.	Names of bidders.	Residence.	Price per cubic yard, measured in scows.
1	Robert Hamilton, jr	Cumberland, Me	$0 24½
2	Augustus R. Wright	Portland, Me	32
3	Boynton Brothers	Boston, Mass	33
4	Augustus B. Martin	Boston, Mass	69

Contract with Robert Hamilton, jr., of Cumberland, Me.; dated May 23, 1883, for dredging in Malden River below the Malden River Bridge.

COMMERCIAL STATISTICS.

LETTER OF COLLECTOR OF CUSTOMS AT BOSTON, MASSACHUSETTS.

CUSTOM-HOUSE, BOSTON, MASS.,
Collector's Office, July 21, 1883.

SIR: * * * Vessels engaged in the coastwise trade are not obliged to enter and clear at this office, only in exceptional cases, and therefore I cannot supply you with any statistics relating thereto that would be of practical value.

No separate record is kept of the value of merchandise discharged at Malden.

Yours, respectfully,

R. WORTHINGTON,
Collector.

Maj. CHARLES W. RAYMOND, U. S. A.

LETTER OF THE CITY CLERK OF MALDEN, MASSACHUSETTS.

CITY OF MALDEN, OFFICE OF CITY CLERK,
August 7, 1883.

DEAR SIR: Your letter of June 11, 1883, was handed me long ago, and should have been answered ere this, but I have endeavored to ge tnearly as correct statements as possible, and as a result submit the following:

Tons of coal	10,000
Schooners of lumber, average 300 tons	25
Schooners of bark, average 300 tons	15
Schooners of miscellaneous goods, last-blocks, stone, &c., average 300 tons	5

Yours, respectfully,

L. D. HOLDEN,
City Clerk.

CHARLES W. RAYMOND,
Major of Engineers, U. S. A.

APPENDIX C.

IMPROVEMENT OF HARBORS AND RIVERS ON THE SOUTHERN COAST OF MASSACHUSETTS AND IN RHODE ISLAND AND CONNECTICUT.

REPORT OF LIEUTENANT-COLONEL GEORGE H. ELLIOT, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1883, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Hyannis Harbor, Massachusetts.
2. Nantucket Harbor, Massachusetts.
3. Wood's Holl, and Harbor of Refuge at Wood's Holl, Massachusetts.
4. Wareham Harbor, Massachusetts.
5. Taunton River, Massachusetts.
6. Pawtucket (Seekonk) River, Rhode Island.
7. Providence River and Narragansett Bay, Rhode Island.
8. Newport Harbor, Rhode Island.
9. Block Island Harbor, Rhode Island.
10. Little Narragansett Bay, Rhode Island and Connecticut.
    Stonington Harbor, Connecticut.

ENGINEER OFFICE, UNITED STATES ARMY,
Newport, R. I., July 31, 1883.

GENERAL: I have the honor to submit herewith annual reports for the year ending June 30, 1883, for river and harbor works in my charge.

Very respectfully, your obedient servant,

GEORGE H. ELLIOT,
Lieut. Col. of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

C 1.

IMPROVEMENT OF HYANNIS HARBOR, MASSACHUSETTS.

There has been no work performed in this harbor since October, 1881.

The breakwater is 1,160 feet in length and covers a well-sheltered area of about 175 acres, with a minimum depth of 9 feet, of which a small portion has a depth of 20 feet.

The utility of this harbor of refuge—it is the only harbor on the north side of Nantucket and Vineyard Sounds between Cape Monomoy and Wood's Holl, a distance of 33 miles—would be greatly increased by deepening the water inside the breakwater, and by placing a light-house and

fog-signal on the easterly end of the breakwater. The present light-house could then be dispensed with.

After the death of General Warren (August 8, 1882) this work was temporarily in charge of Maj. J. W. Barlow, Corps of Engineers. On the 28th of September, 1882, it was transferred to Maj. Franklin Harwood, Corps of Engineers, who continued in charge until his death, March 26, 1883, since which date the work has been in charge of Lieut. Col. George H. Elliot, Corps of Engineers.

Hyannis Harbor is in the Barnstable collection district, and Barnstable is the nearest port of entry. The amount of revenue collected in the last fiscal year could not be obtained from the collector. The nearest light-house is Hyannis light. The nearest fortification is the fort at Clark's Point, New Bedford, Mass.

Money statement.

July 1, 1882, amount available		$278 63
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$18 00	
July 1, 1883, outstanding liabilities	75	
		18 75
July 1, 1883, amount available		259 88

COMMERCIAL STATISTICS.

HYANNIS, *May* 24, 1883.

SIR: Your letter referring to river and harbor improvements received, and I write you the following reply:

During the year 1882 there was received at this port by navigation:

Coal	tons..	6,000
Lumber	feet..	1,250,000
Grain	bushels..	100,000
Fish	barrels..	4,000
Number of vessels arrived for a harbor:		
Schooners		1,400
Steamers		100

Coal vessels with an average draught of 10 feet, about one-third the vessels harboring loaded to 13 feet.

Average tonnage of coal vessels, 250; average capacity of grain vessels, 8,000 bushels; average capacity of lumber vessels, 100,000 feet.

I remain, very respectfully, yours,

ALONZO F. LOTHROP,
Keeper Hyannis Light Station.

Col. GEORGE H. ELLIOT,
Engineer Office, U. S. A.

C 2.

IMPROVEMENT OF NANTUCKET HARBOR, MASSACHUSETTS.

At the date of the last annual report the work of extending the jetty on the west side of the channel of entrance was in progress under a contract with James Scully, of Groton, Conn. Work under this contract and its extension was continued until January, 1883, when it was completed. The total amount of stone delivered under the contract was 16,123 tons.

On the 31st of July, 1882, the late General Warren advertised for proposals to deliver about 16,000 tons of granite in lots of 2,000 tons

or more for a further extension of the jetty, and the following proposals were received and were opened on the 16th August, 1882, by Maj. J. W. Barlow, Corps of Engineers, who was temporarily in charge of the work after the death of General Warren (August 8, 1882).

Names and addresses of bidders.	Price per ton.	Date of commencement.	Date of completion.
Charles H. Edwards, Boston, Mass	2,000 tons, at $2.33; 2,000 tons, at $2.37; 2,000 tons, at $2.43; 2,000 tons, at $2.47; remainder at $2.57.	Sept. 11, 1882	July 1, 1883
John Beattie, Leete's Island, Conn.....	2,000 tons or more, at $2.62.....	Sept. 11, 1882	July 1, 1883
Mount Waldo Granite Works, Frankfort, Me.	2,000 tons, at $3; 2,000 tons, at $3.30; remainder at $3.62.	Sept. 11, 1882	July 1, 1883

The contract, with the approval of the Chief of Engineers, was awarded to Charles H. Edwards, the lowest bidder; date of contract September 9, 1882.

Mr. Edwards commenced the delivery of stone under the above contract October 4, 1882, and continued until the weather and rough water prevented further work during the winter.

On the 24th of November, 1882, by direction of the Secretary of War, the work was transferred to Lieut. Col. George H. Elliot, Corps of Engineers. Work was resumed on May 4, 1883, and continued till the close of the fiscal year, when it was still in progress. In June, 1883, Mr. Edwards applied for an extension of time for completing his contract, and, with the approval of the Chief of Engineers, this time was extended to the 31st August, 1883. Up to the end of the fiscal year there had been delivered under the contract 9,223.78 tons of stone, leaving 3,776.22 tons to complete, which was expected to be delivered during the month of July. The length of the completed stone work at the same date was 2,894 feet, and including the stone and timber work at the inner end, the total length was 3,075 feet.

There has been some settling of the jetty for about 500 feet of its length near the shore end, where it was built in shoal water on fine sand. To rebuild this part of the work to its proper width and height will require about 600 tons of stone.

There have been some minor changes in section in other parts of the jetty by the action of the waves or scour of the bottom, or both, which will require an additional amount of stone, and to prevent the lateral dispersion of the ebb-tide to the westward through the jetty it is proposed to fill with chip stones the interstices of parts of it which were somewhat loosely built. The amount of stone required for both of these objects is estimated at 800 tons, making the whole amount of stone yet required to be placed in the existing part of the work 1,400 tons.

During the last fiscal year frequent surveys have been made to discover what changes, if any, were taking place in the channel and on the shores near the work.

The large deposit of sand west of the jetty, in the angle between the jetty and the shore, still continues. To the eastward of the jetty there has been but little deposit of sand along the shore, and but little change in the channel. Careful soundings from time to time show only minor changes in the depths, but these are generally not constant. One survey may show a deepening and the next one a shoaling in the same locality, but the general result seems to be a slight deepening of the channel, although, by reason of the irregularity of the changes, the navigable depth has not been increased. It was not anticipated that any marked

change would occur before the jetty reached the outer bar, from which (or rather from the outer 12-foot curve) it is now distant 2,785 feet, and it was thought that it might be found, even then, that a second jetty, starting from Coatue Point, on the east side of the entrance, would be required.

The spurs or short jetties built out from Coatue Point to arrest the abrasion of the shore have been somewhat extended during the year, and there seems to be no danger of further damage here.

It is proposed with the remainder of the funds available for this harbor to continue the extension of the west jetty towards the outer bar, since in any event this jetty must be finished to the bar whether the other is found necessary or not, in order to direct the current across it, to protect the channel from waves, from ice, and from the sand which moves with the littoral current from the westward. In continuing the work it is proposed to make it as compact as practicable in order to prevent the dispersion of the ebb-tide through it. It is also proposed to continue the observations to determine the velocity and amount of tidal flow to furnish data on which to fix the width of channel and the location and form of the east jetty should one be required.

The inner harbor of Nantucket is capacious and deep and is admirably situated for a harbor of refuge, and it is with the design of making it such that the improvements are made. The original estimated cost of the work including both jetties was $224,000; of this amount there has been appropriated $100,000, leaving $124,000 to complete.

This improvement has been under the immediate supervision of Assistant Engineer J. P. Cotton.

Nantucket is in the Nantucket collection district and is a port of entry. The amount of revenue collected in the last fiscal year was $75.97. The nearest light-houses are Nantucket Cliff and Brant Point lights. The nearest fortification is the fort at Clark's Point, New Bedford, Mass.

Money statement.

July 1, 1882, amount available		$45,792 15
Amount appropriated by act passed August 2, 1882		25,000 00
		70,792 15
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$22,509 73	
July 1, 1883, outstanding liabilities	14,051 42	
		36,561 15
July 1, 1883, amount available		34,231 00
Amount (estimated) required for completion of existing project		124,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		60,000 00

COMMERCIAL STATISTICS.

LETTER OF MR. JOSEPH B. MACY.

NANTUCKET, *May* 26, 1883.

RESPECTED SIR: Your esteemed favor of the 22d instant came duly at hand, and I hasten to say that I am pleased to be able to give you any information that I may possess touching your inquiries. The following are among the principal imports to our island during the year 1882:

Hard coal	tons	4,000
Gas coal	do	250
Wood	cords	750
Grain	bushels	12,000

Lumber	feet..	1,000,000
Brick		30,000
Railroad iron	tons..	50
Hay	do...	150
Salt	bushels..	3,500
Flour	barrels..	4,000

There was exported from our island during the same time:

Salt fish	pounds..	56,000
Fresh fish	do...	45,000
Shell fish	bushels..	600

About two hundred and thirty-five vessels entered and left our harbor during the year, classified as follows:

179 schooners, average draught 7 feet; tonnage, 110.
40 sloops, average draught 6 feet; tonnage, 45.
16 steamers, average draught 8 feet; tonnage, 290.

The Nantucket steamers run daily (two); average, 480 tons; draught, 5¾ feet, which are not included in the above. Many of the above-named list have entered and sailed many times, say Boston, New York, and New Bedford packets.

Our population will average 4,500, including the summer visitors, who spend two and three months on the island. A large part of the hay and vegetables raised on the island are consumed here. All other supplies, such as groceries, meats, dry goods, furniture, and general supplies, are imported. I send you here accompanying form of our memorial to Congress, showing that our local interests are trifling compared with the national interests to be hoped and looked for.

Should you desire any further information, command me and I will try and obtain it.

Very respectfully,

JOSEPH B. MACY.

GEORGE H. ELLIOT,
Lieut. Col. of Engineers, U. S. A.

MEMORIAL TO CONGRESS.

To the Senate and House of Representatives of the United States:

Respectfully represent that the number of vessels passing through Nantucket Sound on the north side of the island of Nantucket, as noted from the Cross Rip light-ship, is upwards of 30,000 annually; that 75 per centum of this number draw less than 14 feet of water and 50 per centum draw less than 11 feet of water; that, since the year 1800, 530 vessels have been wrecked around this island, the estimated value of which, including cargoes, is upward of $5,000,000, the cargo of one vessel alone being valued at $500,000; that 73 per centum of these disasters occurred upon the north side of the island; that upward of 60 per centum of this number was a total loss; that the number of lives sacrificed by these disasters exceeds 200; that the large amount of property and human life destroyed could have been measurably, if not absolutely, saved, if Nantucket Harbor, which is on the north side of the island and within 9 miles of the track of vessels passing through the Sound, had been open to vessels drawing 14 feet of water; that the Nantucket Bar has always been an obstruction to the harbor entrance for vessels drawing more than 8½ feet of water at high-tide, and consequently the Nantucket Harbor has never been available as a harbor of refuge for the large number of vessels passing through the Sound; that the mail steamer with passengers is frequently delayed from entering the harbor at low-tide, to the detriment of business interests; that there is no adequate harbor of refuge east of Block Island or Newport for vessels detained by the shoals, and none which can be made to afford equal advantages with Nantucket Harbor, provided the water over this sand-bar can be deepened to a depth of 14 feet by means of a jetty, as recommended by the recent report of General G. K. Warren, of the United States Board of Engineers; and that with a harbor at Nantucket capable of accommodating vessels drawing not more than 14 feet of water, commerce will not only be rendered more safe, but greatly expedited, and, as northerly winds prevail during the severe storms, Nantucket Harbor can be reached without difficulty.

They therefore respectfully pray your honorable bodies to make an appropriation in accordance with the suggestions in General Warren's report for the permanent improvement of Nantucket Harbor.

JANUARY, 1880.

LETTER OF COLLECTOR OF CUSTOMS AT NANTUCKET, MASSACHUSETTS.

CUSTOM-HOUSE, NANTUCKET, MASS.,
Collector's Office, June 14, 1883.

SIR: In reply to your letter dated May 22, 1883, I have the honor to submit the following report as far as obtained to date. I should have rendered a report ere this but have been delayed awaiting returns from the Nantucket and New Bedford Steamboat Company, which has not been received, and will be forwarded as soon as possible.-I consider the company's report of the utmost importance, as it will swell the aggregate amounts largely.

Very respectfully,

W. P. HILLER,
Collector.

GEORGE H. ELLIOT,
Lieut. Col. Engineers, U. S. A.

STATEMENTS OF THE AGGREGATE AMOUNTS OF THE STAPLE ARTICLES OF FREIGHT AND GENERAL MERCHANDISE RECEIVED AND SHIPPED BY SAIL-VESSELS DURING THE YEAR OF 1882, IN THE DISTRICT OF NANTUCKET, MASSACHUSETTS.

Coal	tons..	6,000
Iron	do...	200
Grain	bushels..	20,000
Lumber	feet..	1,500,000
General merchandise	tons..	3,200
Arrivals and departures:		
Steam, 716	tons..	380,369
Sail, 349	do...	20,940

Average draught, 7 feet 6 inches.

W. P. HILLER,
Collector.

C 3.

IMPROVEMENT OF WOOD'S HOLL AND HARBOR OF REFUGE AT WOOD'S HOLL, MASSACHUSETTS.

At the date of the last annual report no work was in progress.

By the act of Congress of August 2, 1882, $52,000 was appropriated for a harbor of refuge at Wood's Holl, an estimate for which had been submitted by the late General Warren. This estimate contemplated the construction of a breakwater pier, a basin for the use of the United States Fish Commission, and wharves for the use of that Commission and other branches of the public service. The proposed site of the works had been provisionally acquired by the Commission. On the 8th of September, 1882, Maj. J. W. Barlow, Corps of Engineers, in temporary charge after the death of General Warren (August 8, 1882), submitted a project for the expenditure of the appropriation.

By direction of the Secretary of War the work was transferred to Lieut. Col. George H. Elliot, Corps of Engineers, on the 24th November, 1882.

The project was approved by the Secretary of War on the 2d of February, 1883, and the fee-simple title to the land was acquired by the United States Fish Commission April 20, 1883, but the title was not formally approved by the United States Attorney-General until June 2, 1883. A general law of the United States, which prohibits any expenditure upon land before the approval of the title by the Attorney-General delayed the commencement of work upon the pier, but it was held that this law would not prevent the removal of the bowlders, many of them of large size, which thickly covered the site of the proposed pier and wharves, in depth of water varying from 3 to 20 feet at mean

low water. Advertisement was therefore issued March 13, 1883, for proposals for the removal of these bowlders, and the following were received and were opened on March 24, 1883:

Names and addresses of bidders.	Price.	Date of commencement.	Date of completion.
	Per cu. yd.		
George W. Townsend, Boston, Mass	$5 00	April 7, 1883	June 1, 1883
Hiram W. Phillips, Quincy, Mass	5 35	April 7, 1883	June 1, 1883
John Waters, Newport, R. I	6 80	April 7, 1883	June 1, 1883
C. E. Davis, Falmouth, Mass	12 50	April 7, 1883	June 1, 1883

The contract, with the approval of the Chief of Engineers, was awarded to George W. Townsend, the lowest bidder; date of contract April 7, 1883.

The contract was completed on the 5th of June, 1883.

After correspondence with the United States Commissioner of Fish and Fisheries, plans and specifications were prepared for the retaining and pier walls required for the work, and advertisement was issued June 4, 1883, inviting proposals for their construction, to be received and opened on the 6th of July, 1883. The retaining walls are to be built along the front of the old marine railway in the Great Harbor at Wood's Holl in about 6 feet of water at mean low-water, and of an aggregate length of about 520 feet. The pier walls, of an aggregate length of about 570 feet, and founded in water from 10½ to 20 feet depth at mean low-water, are to form a hollow pier in front of the retaining walls. By the terms of the specifications the contractor is to commence the construction on or before August 9, 1883, and complete it within twelve months thereafter. The estimated quantities of work are as follows:

Dredging	cubic yards	3,000
Stone work in place in the retaining walls	do	1,150
Stone work in place in the pier walls	do	2,150
Riprap in place in the foundations	tons of 2,240 pounds	1,350
Bowlders containing more than one-half cubic yard to be removed from the trenches for foundations	tons of 2,240 pounds	300

Judging from the lettings of similar kinds of work elsewhere it is probable that the present appropriation will not be sufficient for anything more than the work already advertised for, and that the wharfing, the filling in behind the retaining walls, and the dredging inside the pier and in front of the wharves, will have to be provided for by future appropriations. The estimated cost of them is $25,000.

Near Wood's Holl is a strait of that name which is one of the most important entrances into Buzzard's Bay. In this strait the channel is so narrow and the tidal currents are so swift and irregular that the late General Warren submitted a project some years since for its improvement by the removal of rocks and bowlders, at an estimated cost of $446,000. He said of this work:

> This improvement may truly be called a national one. It is not for the benefit of any special locality. It is for a highway uniting two large bodies of navigable waters extensively used by the commercial vessels of the United States, and when thoroughly improved it will tend greatly to a saving of time and diminish the dangers of coast navigation.

General Warren made a full report on the subject of this improvement December 31, 1873, and it was printed in House Ex. Doc. 84, Forty-third Congress, second session. In 1878 an appropriation of $15,000 was made for clearing the strait of the most dangerous rocks and for deepening the entrance to the Little Harbor of Wood's Holl.

The work of improvement at Wood's Holl has been under the immediate supervision of Assistant Engineer J. P. Cotton.

Wood's Holl is in the Barnstable collection district. New Bedford is the nearest port of entry. The amount of revenue collected at New Bedford in the last fiscal year was $78,998.86. No information could be obtained from the collector of the amount of revenue collected at Barnstable. The nearest light-house is Nobska light. The nearest fortification is the fort at Clark's Point, New Bedford, Mass.

Money statement.

July 1, 1882, amount available		$567 07
Amount appropriated by act passed August 2, 1882		52,000 00
		52,567 07
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$2,139 73	
July 1, 1883, outstanding liabilities	436 24	
		2,575 97
July 1, 1883, amount available		49,991 10
Amount (estimated) required for completion of existing project		25,000 00
Amount (estimated) required for additional work		431,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		100,000 00

COMMERCIAL STATISTICS.

PACIFIC GUANO COMPANY,
Wood's Holl, Mass., June 11, 1883.

DEAR SIR: In reply to your favor of 22d May, to Mr. J. M. Glidden, we would say that our books show the following receipts and deliveries for the year 1882.

Ninety-one vessels have discharged at our wharves, and for our consumption, 26,344 tons of merchandise, viz:

11 vessels with coal cargoes	tons..	2,743
15 vessels with phosphate cargoes	do...	11,540
2 vessels with kainit cargoes	do...	2,440
5 vessels with nitrate of soda	do...	3,162
10 vessels with brimstone	do...	2,488
5 vessels with muriate of potash		586
26 vessels with fish scrap		3,385

17 vessels with barrels and bags.

We have shipped from these works 31,999 tons of soluble Pacific guano by seventy-two vessels, varying in capacity from 100 to 1,000 tons, and in draught of water from 10 to 19 feet.

The fifteen vessels received with phosphate rock were from 600 to 1,000 tons, and in draught of water from 14 to 19 feet.

Six of the above vessels were foreign, and were loaded with brimstone, kainit, and nitrate of soda, and draw from 18 to 20 feet of water.

There were received by other parties in town during the same time, twelve vessels with 3,500 tons of coal; four vessels, with lumber, lime and cement, and one vessel with 100 tons of hay.

Two thousand six hundred barrels of fresh fish have been shipped from this port by steam and sailing-vessels.

The number of vessels which have made this a harbor of refuge during the year 1882 it is impossible to accurately ascertain. The number has, however, been quite large. Many times during the winter eight and ten vessels are waiting at one time for weather to change and allow them to proceed. Many vessels also put in here to await orders, and it has always been a harbor for many yachts, and pleasure seekers of all descriptions, during the season.

Trusting you may find the above facts of use in connection with your report upon our harbor,

I am, very respectfully,

ASA SHIVERICK,
Manager.

GEO. H. ELLIOT,
Lieut. Col. of Engineers, U. S. A.

C 4.

IMPROVEMENT OF WAREHAM HARBOR, MASSACHUSETTS.

At the date of the last annual report no work was in progress.

By act of Congress of August 2, 1882, $5,000 was appropriated for continuing the improvement, and Maj. J. W. Barlow, in temporary charge after the death of General Warren (August 8, 1882), submitted a project for its expenditure, which contemplated the further construction of works at Long Beach at the mouth of the harbor, designed to protect it from the sea, it having been found that the abraded material was washed into the harbor and decreased the depths gained by dredging under former appropriations. Major Barlow recommended that the stone and brush required be purchased in open market, and that the work be done by hired labor. The project and recommendation were approved by the Chief of Engineers.

On the 28th of September, 1882, by direction of the Secretary of War, the work was transferred to Maj. Franklin Harwood, Corps of Engineers, who continued in charge until his death, on the 26th of March, 1883.

The subsequent operations were as follows: A wall of brush and stone, 150 feet in length, similar to those formerly built at this place, was constructed across the west end of the beach near the line of mean high water, and another of the same kind, 950 feet long, commencing near the west end of the stone and brush wall built in 1878, was built parallel to and 15 feet from it. A vertical sand-catch fence, 10 feet high and 1,032 feet long, of scantling and boards, similar to those which have been successfully built on the shores of the western lakes, was built between these parallel stone and brush walls. Another sand-catch fence, 7 feet high, similar, but inclined towards the sea, was built from the end of the vertical fence just mentioned 832 feet to the eastward. These wooden sand-catch fences are economical—they cost about 60 cents per running foot while the stone and brush walls cost about $1.10 per running foot—but have not been as successful as was anticipated. Near the eastern part, where there was sufficient width of foreshore of dry sand, there has been some addition to the height of the beach, but on the seaward side of the western portion the foreshore is too narrow for the accumulation of dry blown sand, for the collection of which this kind of fence only is effectual. This part of Long Beach—which is a long, narrow strip separating the ocean and the bay—is washed during high tides and storms, and here we must look for the raising of the beach by the accumulation of wet sand by means of the brush and stone walls which have heretofore been successfully used at Long Beach.

On the 27th of March, 1883, the work of improvement in this harbor, by direction of the Chief of Engineers, was placed in charge of Lieut. Col. George H. Elliot, Corps of Engineers, and further labor at Long Beach was for special reasons deferred until the 21st of June, 1883, when the construction of sand-catch walls of stone and brush was commenced at the north side, which had worn so much as to endanger the works previously built. Two hundred and seventy-two feet of these walls were completed up to the end of the fiscal year. In addition to this an area of 30 feet square on the sea side, where it is washed by the waves, was covered with brush weighted down with stone, as an experiment. It is thought that the sand brought in by the waves will be caught and that in this way the beach may be raised.

With the remainder of the appropriation it is designed to continue the stone and brush wall, just built on the north side of the point, about 310 feet further to the eastward; to build six spurs, each about 20 feet long, running westward from the stone and brush wall which has been built across the west end of the point; to build out from the south side of the point four additional stone and brush jetties of a total length of about 500 feet; and to fill inside the triangular frames on which the wooden sand-catch fence has been built, with brush, with the view of catching the wet sand which is now washed through this fence by the waves from seaward.

The amount of the last appropriation was not considered sufficient to warrant any attempt to continue the work of deepening the harbor, which constituted the main portion of the original project, and is yet incomplete.

The estimated cost of the work in Wareham Harbor was $44,050. Of this amount there has been appropriated $15,000.

This work has been under the immediate supervision of Assistant Engineer J. P. Cotton.

Wareham is in the New Bedford collection district. New Bedford is the nearest port of entry. The amount of revenue collected in the last fiscal year was $78,998.86. The nearest light-houses are Bird's Island and Wing's Neck lights. The nearest fortification is the fort at Clark's Point, New Bedford, Mass.

Money statement.

July 1, 1882, amount available		$397 45
Amount appropriated by act passed August 1, 1882		5,000 00
		5,397 45
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,020 13	
July 1, 1883, outstanding liabilities	386 06	
		3,406 19
July 1, 1883, amount available		1,991 26
Amount (estimated) required for completion of existing project		29,050 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		15,000 00

COMMERCIAL STATISTICS.

WAREHAM, MASS., *July* 2, 1883.

DEAR SIR: Herewith I mail of you in tabulated form the best information which I have been able to obtain in respect of the inquiry contained in your communication under date of May 22 last, relative to the commercial statistics of this port.

I am, sir, very respectfully, your obedient servant,

GERARD C. TOBEY.

Col. GEORGE H. ELLIOT,
Engineer Office, U. S. A.

Tabulated statement of the annual commerce of Wareham, Mass., in certain enumerated articles.

Articles.	Received and shipped by water.			Received and shipped by rail.			Total valuation by water and rail.
	Imports.	Exports.	Valuation.	Imports.	Exports.	Valuation.	
Barrels.....number..	250	.....	$75	6,100	.....	$2,745	$2,820
Castings, brass	.....	.....	.....	.....	.....	50,000	50,000
Castings, iron.....tons..	.....	.....	.....	.....	650	48,000	48,000
Cranberries .....barrels..	.....	400	4,000	20	5,850	58,700	62,700
Coal:							
Bituminous .....tons..	25,450	.....	117,070	.....	.....	.....	117,070
Anthracite.....do....	5,575	300	34,050	.....	1,400	8,400	42,450
Flour .....barrels..	548	50	4,900	4,452	1,000	43,488	48,388
Grain .....bushels..	200,000	.....	180,000	9,000	150,000	143,100	323,100
Hoops .....number..	.....	.....	.....	1,500,000	.....	6,750	6,750
Iron:							
Pig .....tons..	8,325	.....	185,990	.....	.....	.....	185,990
Plate .....do....	.....	100	8,800	4,000	2,200	389,800	398,600
Merchant .....do....	.....	.....	.....	.....	5,622	298,000	298,000
Scrap .....do....	3,250	.....	97,500	6,675	102	203,750	301,250
Swedish bars .....do....	.....	.....	.....	1,200	.....	102,000	102,000
Iron ore.....do....	2,775	.....	21,200	.....	.....	.....	21,200
Kegs .....number..	.....	100,000	15,000	.....	113,740	17,061	32,061
Lumber:							
Eastern .....feet..	625,000	.....	12,000	327,500	60,000	7,139	19,139
Box boards .....do....	.....	1,900,000	20,700	.....	500,000	5,500	26,200
Nails .....kegs..	.....	102,000	382,500	.....	109,040	408,900	791,400
Oysters, seed, and shell fish, barrels	.....	2,900	4,000	.....	1,883	9,400	13,400
Sand, furnace and foundry, tons	420	12,040	8,020	.....	.....	.....	8,020
Staves.....number..	.....	2,000,000	5,500	.....	2,000,000	5,500	11,000
Total.....	.....	.....	1,101,305	.....	.....	1,808,233	2,909,538

There is a smaller commerce in brick, lime, hay, clay, shells, wood, boats, cement, and similar coastwise traffic.

Wareham is the nearest port to Sandwich and to the inland towns of Middleborough, Bridgewater, and Brockton, the commerce and manufactures of each of which equal those of Wareham. The railroad wharves of Wareham have direct railway connection with these and other tributary towns, but inadequate navigation facilities in Wareham Harbor oblige these towns to receive their water-borne supplies via Fairhaven and Somerset.

The total tonnage of vessels hailing from Wareham is 6,002 tons, so far as known. The commerce of the port is not, however, carried in these, but more generally is transported by water in other vessels of the United States.

The yearly arrivals and departures at this port comprise, together, about three hundred and fifty sailing vessels, and also occasional steamers, and numerous small craft. The supplies for the iron mills are brought in schooners of 350 to 600 tons burden, manufacturers considering it profitable to employ larger vessels than formerly in freighting cargoes of coal and iron. The wharves in Wareham Harbor are rendered difficult of approach for such vessels by reason of bars in the tortuous channel. The nature of the above mentioned industries of this town is such that its railway traffic is dependent upon the facilities for navigation.

C 5.

IMPROVEMENT OF TAUNTON RIVER, MASSACHUSETTS.

At the date of the last annual report work was being prosecuted, under a contract with Mr. William H. Beard, in dredging to secure, between Weir and The Needles, a depth of 11 feet at mean high-water, with a least width of 60 feet, and additional width at the bends.

Up to January 1, 1883, there had been removed 40,313 cubic yards,

and the enlarged channel was carried from Phillips's Wharf to Burt's Turn, a distance of 1½ miles. Work was resumed under the same contract on the 12th of April, 1883, and continued until the 11th of May, 1883, when it was completed, except a small amount of work at the fishery near North Dighton, which was left until the fishing season was over.

By act of Congress of August 2, 1882, $25,000 was appropriated for continuing the improvement of Taunton River, and Maj. J. W. Barlow, Corps of Engineers, in temporary charge after the death of General Warren (August 8, 1882), divided the work into two sections, and advertised on the 16th of September, 1882, for proposals.

In the first section (The Needles, Brigg's Shoal, The Nook, and a part of the river at Wikamount) the material was stated to be sand, gravel, clay, pebbles, and bowlders under 2 tons. In the second section (Berkeley Bridge Shoal, a part of the river at Wikamount, and between Peter's and Ferry Points) the material was stated to be mud, sand, and gravel.

The channel was to be made 11 feet deep at mean high-water above Berkeley Bridge Shoal, and 12 feet on and below that shoal, the existing depths being from 5 feet to the proposed depths. The following bids were received:

Names and addresses of bidders.	Price per cubic yard, first section.	Price per cubic yard, second section.	Date of commencement.	Date of completion.
J. H. Fenner, Jersey City, N. J	$1 50	$0 35	Nov. 1, 1882	June 30, 1883
W. H. Beard, Brooklyn, N. Y	96⅞	48½	Nov. 1, 1882	June 30, 1883
James Caler & Son, Stamford, Conn	1 65	70	Nov. 1, 1882	June 30, 1883

With the approval of the Chief of Engineers, the contracts were awarded to Mr. W. H. Beard, the lowest bidder for the first section, and to Mr. J. H. Fenner, the lowest bidder for the second section.

Abstract of contracts.

Contractors.	Residence.	Date of contract.	Subject of contract.	Price.	Date of commencement.	Date of completion.
				Per cu. yd.		
W. H. Beard.	Brooklyn, N. Y.	Nov. 1, 1882	Dredging in first section, Taunton River.	$0 96⅞	Nov. 1, 1882	June 30, 1883
J. H. Fenner.	Jersey City, N. J.	Oct. 30, 1882	Dredging in second section, Taunton River.	35	Nov. 1, 1882	June 30, 1883

On the 24th of November, 1882, the work, by direction of the Secretary of War, was transferred to Lieut. Col. George H. Elliot, Corps of Engineers.

Mr. Beard commenced work under his contract at The Needles, and up to the end of the fiscal year he removed 5,672.82 cubic yards from that shoal and from Brigg's Shoal. The work is still in progress, and with the approval of the Chief of Engineers the time for completion of the contract has been extended to August 15, 1883.

There is now a continuous channel 11 feet deep at mean high-water from the bridge at Weir to Brigg's Shoal, a distance of 3 miles, but there are many scattering bowlders in the channel which were not included in the dredging contract, and which will be removed later in the season.

The narrowness of the channel making it difficult for the tows of the two contractors to pass each other, the time for commencing the execution of the contract with Mr. Fenner has, with the approval of the Chief of Engineers, been extended to August 15, 1883, or such time as the Beard contract shall have been completed, and its completion to December 31, 1883. It has not been commenced.

The remainder of the work near North Dighton will be completed early in this fiscal year.

Of the approved project the following still remains to be done: The remainder of the dredging through Brigg's Shoal and dredging at Berkeley Bridge Shoal, also at The Nook, at Wikamount, at Cobb's Shoal, and between Cobb's and Ferry Point. The bowlders on the bottom and sides of the channel and the ledge which crosses the channel at Peter's Point are to be removed. A portion of this work is provided for by the remainder of the current appropriation.

The estimated cost of the approved project for the improvement of this river was $94,000, of which $67,500 has been appropriated, leaving $26,500 to complete.

Taunton, at the head of navigation of Taunton River, requires large quantities of coal, iron, clay, mouldings, sand, and other heavy articles for its extensive manufactures which depend on water transportation for successful competition.

The completed improvement will enable three and four masted schooners carrying from 600 to 1,400 tons, and barges of equal capacity, to reach Taunton. Before the improvement of the river, it was navigated by vessels of a maximum capacity of about 30 tons.

During the fiscal year this improvement has been under the immediate supervision of Assistant Engineer J. P. Cotton.

Taunton River is in the Fall River collection district. Fall River is the nearest port of entry. The amount of revenue collected in the last fiscal year was $93,834.61. The nearest light-house is Borden's Flats light. The nearest fortification is Fort Adams, Newport, R. I.

Money statement.

July 1, 1882, amount available		$23,702 36
Amount appropriated by act passed August 2, 1882		25,000 00
		48,702 36
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$20,723 12	
July 1, 1883, outstanding liabilities	7,040 89	27,764 01
July 1, 1883, amount available		20,938 35
Amount (estimated) required for completion of existing project		26,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		26,500 00

COMMERCIAL STATISTICS.

TAUNTON, *June* 11, 1883.

DEAR SIR: In reply to yours of May 22, in regard to aggregate amounts of articles of freight on Taunton River in 1882, will say the following is as near a correct statement as we can give you:

Grain	bushels	950,000
Flour	barrels	36,000
Cotton	bales	24,000
Lumber	feet	9,000,000
Coal	tons	225,000
Iron ore and metals	do	35,000
Clay	do	22,000
Miscellaneous merchandise	do	15,000
Moulding sand	do	48,000

The following vessels, steamers, barges, and tugs belong to Taunton:

SCHOONERS.	Tons.
Whirtlen	90
Roanoke	100
John Lojier	100
Emma	100
Ida	100
S. L. Crocker	150
Salmon Washburn	150
S. W. Ponder	170
Sylvester Hale	180
R. S. Dean	185
Hickman	180
S. T. Charter	200
H. P. Halleck	200
M. M. Merriman	250
Abel W. Parker	350
Wm. F. Green	375
N. H. Skinner	450
Theodore Dian	500
Wild Pigeon	500
Stephen Morgan	500
Oliver Ames	600
William Mason	650
Wm. D. Marvel	650
Colvin P. Harris	700
Alfred Brabrook	800
D. M. Anthony	800
Wm. R. Hurton	900
B. F. Walker	1,000
C. A. Briggs	1,100
Mabel L. Phillips	1,200
Hattie S. Williams	1,300
Saml. H. Walker	900
Wm. O. Snow	900

SCHOONERS—continued.	Tons.
Wm. Walker	900
Bowen Wood	850
S. M. Thomas	1,100
B. L. Burt	1,000
Nathan Lawrence	1,100
W. L. Roberts	1,100
C. N. Simmons	1,100
Josie L. Burt	1,100
Emma F. Angel	1,300
Bertha Dean	1,100
Elliot B. Church	1,750
BARGES.	
Advance	500
Pioneer	750
Petersburg	800
Star of the East	850
Satumella	1,000
Transport	1,000
Tybee	1,100
H. Y. Dwenny	900
Berkley	450
STEAMERS.	
Empire State	1,700
TUGS.	
Cora L. Staples	150
Geo. A. Dian	140
J. P. White	75
Theo. Birley	35

Very respectfully,

STAPLES & PHILLIPS.

GEO. H. ELLIOT,
Lieut. Col. of Engineers, U. S. A.

C 6.

IMPROVEMENT OF PAWTUCKET (SEEKONK) RIVER, RHODE ISLAND.

The project as far as adopted and approved was completed some years since.

The mouth of the river is obstructed by two bridges with badly arranged draws; but Washington Bridge, which interferes with navigation more than the other (the railroad bridge) is to be rebuilt under an act passed by the legislature of Rhode Island at the January session of 1883, and, the obstruction caused by this bridge which has heretofore been a bar to recommendations by the engineer officer in charge of the district for further appropriations for the improvement of the river, will now be removed.

The following is an extract from the act referred to:

AN ACT providing for clearing the channel of the Seekonk River, at India Point, in Providence, of obstructions; and for the construction of a bridge near the site of the Providence Washington Bridge.

It is enacted by the General Assembly as follows:

SECTION 1. The city of Providence may elect, on or before the first day of July, A. D. 1883, to remove forthwith the stone and other materials deposited in the Seekonk River under and near Washington Bridge, so called, at India Point, in said city, from said river, and cause the channel thereof under and around said bridge to be dredged and cleared of all obstructions to the flow of the tides into and out of said river, to a depth of 15 feet at low-water, and reconstruct said bridge with a swing-draw in the main channel of said river, with an opening on each side of said draw, not less than 80 feet wide, for the safe and convenient passage of vessels navigating said river, through the same, in such manner as the harbor commissioners shall approve.

SEC. 2. If the said city council shall elect within the time limited in the preceding section, to dredge and clear the channel of said river and reconstruct said Washington Bridge in the manner prescribed in said section, the city shall cause said work to be completed to the satisfaction of the harbor commissioners within one year from the time such election shall be made by said city council, and the obligations of said city under an act entitled "An act in relation to the Providence Washington Bridge and the draws in the bridges of the Seekonk River," passed at the January session, 1859, and accepted by said city April 12, 1859, to maintain and keep in repair said Washington Bridge and draw, shall remain in full force in respect to said reconstructed bridge and draw.

SEC. 3. If the city council of the city of Providence shall not elect within the time limited in section 1, to reconstruct said Washington Bridge in the manner aforesaid, a new bridge over said river on or near the site of said Washington Bridge, shall be built with a swing-draw therein with an opening on each side of said draw not less than 80 feet wide, so located with reference to the channel and currents of the river as to be most safe and convenient for the passage of vessels navigating said river, through the same, in such place and manner as shall be determined by five bridge commissioners of whom two shall be appointed by the city council of said city, two by the governor, and one by the the town council of the town of East Providence. And if said new bridge shall be constructed upon the site of the present Washington Bridge, the said commissioners shall first remove said Washington Bridge and dredge and clear the channel under and near the same, of all obstructions to the flow of the tides and to navigation, to a depth of not less than 15 feet at low-water.

SEC. 4. The bridge commissioners so appointed shall cause within two years from the time of their appointment, said new bridge to be constructed and completed according to plans and specifications by them approved, and when the same shall be completed and opened for public travel, the said commissioners, in case said bridge shall be on a site other than that of the present Washington Bridge, shall cause the present Washington Bridge to be removed from said river, together with the piers and piling thereof and connected therewith, and shall also cause the channel of said river to be dredged under and about said Washington Bridge and said new bridge, to a depth of not less than 15 feet at low-water, and in such manner as the harbor commissioners may direct, and deliver to said city the materials composing said bridge, piers, and piling for the use of said city.

An allotment has been made from the appropriation for the examination and surveys of rivers and harbors, contained in the act of Congress of August 2, 1882, for the survey of this river. The survey and report thereon will be made in time for action at the next session of Congress.

After the death of General Warren (August 8, 1882) this work was in temporary charge of Maj. J. W. Barlow, Corps of Engineers, until the 24th of November, 1882, when, by direction of the Secretary of War, it was transferred to Lieut. Col. George H. Elliot, Corps of Engineers.

Pawtucket is largely engaged in commerce and manufactures, and the larger size and draught of sailing vessels of late years makes it desirable that the navigable depth of the river should be increased.

Pawtucket River is in the Providence collection district, and that port is the nearest port of entry. The amount of revenue collected at Providence in the last fiscal year was $256,443.50. The nearest light-house is Sassafras Point light. The nearest fortifications are Fort Adams, Newport, R. I., and the fort at Dutch Island, R. I.

Money statement.

July 1, 1882, amount available	$529 58
July 1, 1883, amount available	529 58

COMMERCIAL STATISTICS.

LETTERS OF PAWTUCKET BUSINESS MEN'S ASSOCIATION.

1.

PAWTUCKET, R. I., *June* 14, 1883.

DEAR SIR: Your favor of May 22, addressed to the Pawtucket Business Men's Association, was duly received, and the undersigned, a committee appointed by said association to obtain the information desired, most respectfully submit the following statistics of the commerce in Pawtucket River for the year 1882:

IMPORTS.

Coal	tons	86,000
Iron	do	5,300
Gravel	do	300
Clay	do	50
North River stone	do	500
Paving stone	do	240
Brick		2,000,000
Ammonia water	barrels	210,000
Lime	do	2,500
Cement	do	15,000
Long lumber	feet	9,000,000
Short lumber, as shingles, laths, clapboards, &c	do	3,000,000
Spool lumber (about)	do	2,000,000

The above merchandise was received chiefly by barges and sailing vessels carrying from 150 to 600 tons each, and drawing from 7½ to 11 feet of water.

The number of water-craft passed through the draw-bridges for the year 1882 was as follows:

Steamboats	402
Tow-boats	760
Sailing vessels	413
Sail-boats	248
Miscellaneous	458
Total	2,281

We would call attention to the fact that the commerce upon the river is steadily increasing; also that extensive manufacturing establishments are now being erected upon the banks of the river, which will greatly increase the commerce upon the same, and in order to meet the demand for transportation in large barges and sailing vessels increased facilities to navigate the Pawtucket River should be made by widening and deepening the channel and removing the obstructions.

We wish especially to call attention to an obstruction known as Seal Rock, lying nearly in the middle of the channel of the river at the head of navigation, and we hope that such recommendation will be made as will cause its removal.

All of which is most respectfully submitted.

GEO. E. NEWELL,
GEO. P. GRANT,
HENRY F. JENKS,
Committee.

GEO. H. ELLIOT,
Lieut. Col. of Engineers, U. S. A.

2.

PAWTUCKET, *August* 2, 1883.

DEAR SIR: We, the undersigned committee, beg leave to submit the following supplemental report in accordance with your request to furnish additional information respecting the commerce and manufactures that would be benefited by further improvement of the Pawtucket River.

Pawtucket, situated at the head of navigation, 4 miles above Providence, becomes

a distributing point for merchandise to supply an extensive inland trade. Among the towns which draw more or less of their supplies from Pawtucket may be mentioned East Providence, Seekonk, Rehoboth, Attleboro, Mansfield, Wrentham, Franklin, Cumberland, Lincoln, Smithfield, and North Providence.

Pawtucket naturally commands the trade of the territory for half the distance to Boston and entire valley of the Blackstone River. One hundred and thirty trains over Boston and Providence, the Providence and Worcester, and the New York and New England railroads pass through this place daily. Its convenience for transportation by rail, the facility with which its citizens can reach all the large centers of business, together with its manufacturing and mechanical industries, have attracted people from various parts of the world to settle here.

The growth of Pawtucket has been rapidly increasing. In 1865 there were 5,000 inhabitants; at the present time, 1883, there are between 23,000 and 25,000. If we include the immediate villages of Central Falls, Valley Falls, Lonsdale, and Saylesville, we may safely say we have a population upwards of 35,000.

Within these limits there is a great variety and a vast amount of manufacturing and mechanical industries carried on, and from which the General Government has in years past received large revenues. They paid during the fiscal year ending June 30, 1866, $636,691.98 into the office of the assessors for internal revenue for the first district of Rhode Island.

The revenue from the Pawtucket post-office for the fiscal year ending December 31, 1882, was $12,298.28, which will give you some idea of the business which is transacted here at the present time.

Pawtucket is largely a manufacturing community, and in the extent and variety of its manufactures is not surpassed by any place of equal size in the United States. It contains some of the largest establishments of their kind which are to be found in the country, among which may be mentioned the Conant Thread Company, manufacturers of the J. & P. Coats spool cotton, with a capital of $3,000,000, and employing over 2,000 operatives, and consuming in the single item of coal 20,000 tons annually.

The W. F. & F. C. Sayles bleacheries, with their manufacturing establishments, employ over 1,500 hands, and their consumption of coal per annum is 15,000 tons.

The Rhode Island Horse Shoe Company, situated in Valley Falls, in the immediate vicinity of this place, is the largest of its kind in the world, and calls for a transportation of 150 tons per day, with a consumption of 12,000 tons of coal per annum.

Without entering further into detail, would add that not less than $25,000,000 are invested in the different manufacturing industries, all of which could not fail of being benefited by the removal of the obstructions and the improvement of the channel of the Pawtucket River.

The specific improvements needed to put the river in proper condition are the removal of the obstructions at the Railroad and Washington Bridges, the straightening, widening, and deepening of the channel, so that when completed it shall have a width of 150 to 200 feet, and a depth of 12 feet at low-water; also the removal of Seal Rock, near the head of navigation.

Provision has been made by the State government for the removal of the present Washington Bridge and the obstructions under the same, making a depth of water of not less than 15 feet at low-water; also providing for five commissioners, to be appointed by the State, the town of East Providence, and the city of Providence, to execute the foregoing provision, build a bridge in place of the present Washington Bridge with a draw having two openings of 80 feet in width, and two years' time has been allowed the commissioners for the completion of the work. Commissioners have already been appointed by the State and the town of East Providence.

All of which is most respectfully submitted.

GEO. E. NEWELL,
GEO. P. GRANT,
HENRY F. JENKS,
Committee of Pawtucket Business Men's Association.

GEO. H. ELLIOT,
Lieut. Col. U. S. Engineers.

C 7.

IMPROVEMENT OF PROVIDENCE RIVER AND NARRAGANSETT BAY, RHODE ISLAND.

At the date of the last annual report no work was in progress, the previous appropriation having become exhausted April 26, 1882.

By the act of Congress of August 2, 1882, $125,000 was appropriated for this work; and Maj. J. W. Barlow, Corps of Engineers, in temporary

charge after the death of General Warren (August 8, 1882), submitted a project for its expenditure. This project, which was in accord with a project previously submitted by General Warren, contemplated the dredging of a channel 300 feet wide and 25 feet deep at mean low water from Fox Point, in the city of Providence, to the deep water of Narragansett Bay, and it was recommended that the whole sum of $125,000 be devoted to securing as much of this width of 300 feet as the money would pay for. The project was approved by the Chief of Engineers, and Major Barlow divided the proposed work into two sections—the first section being the portion of the river below Field's Point, and the second section being the portion of the river between Field's Point and Fox Point—with the design of making one contract for the whole work or separate contracts for the two sections, as the interests of the United States might require. Proposals for the work were invited by advertisement September 16, 1882, and the following were received and were opened October 10, 1882:

Names and addresses of bidders.	Price for both sections.	Date of commencement.	Date of completion.
	Per cu. yd.		
Atlantic Dredging Company, Brooklyn, N. Y	$0 16	Nov. 1, 1882	Dec. 1, 1883
H. H. & A. J. Beardsley, Bridgeport, Conn	17	Nov. 1, 1882	Dec. 1, 1883
Ross & Sandford, Jersey City, N. J	17§	Nov. 1, 1882	Dec. 1, 1883
George E. Runyan, Portland, Me	23	Nov. 1, 1882	Dec. 1, 1883

The contract, with the approval of the Chief of Engineers, was awarded to the Atlantic Dredging Company, the lowest bidder for both sections; date of contract October 30, 1882.

On the 24th of November, 1882, the work, by direction of the Secretary of War, was transferred to Lieut. Col. George H. Elliot, Corps of Engineers.

Dredging under the above contract had been commenced October 20, 1882, and it was carried on, with a few interruptions from ice, in dredging the Fox Point Channel, the Sassafras Point Channel, and that part of the Field's Point Channel which lies above Field's Point, until March 22, 1883. During this time 312,604 cubic yards were removed, making the following widths, viz: 180 feet in the Fox Point Channel; 230 feet in the Sassafras Point Channel, and 200 feet in the Field's Point Channel.

Work was then commenced at the Gaspee Channel. It continued until May 26, 1883, and 117,264 cubic yards were removed in making a width of 200 feet. The dredging machine was then removed to the Pawtuxet Channel, and work on it has continued to the end of the fiscal year. The width gained in this channel on the 30th June, 1883, was 120 feet, and the quantity of material removed from it was 72,436 cubic yards.

Before determining the lines of the deep channels to be dredged below Field's Point, a survey of the river from that point to Conimicut Point was made, and these channels, as well as the 25-foot channels above Field's Point, have been laid out in the straight reaches before mentioned (with proper enlargement at the angles), with a view both to economy of excavation and facility of lighting them by a system of range or leading lights, such as have been found necessary in the navigation of the dredged channels in the Delaware River, Chesapeake Bay, and other localities. The Providence Board of Trade, adopting the suggestion, passed the following resolutions at its monthly meeting on the 1st of May last:

RESOLUTIONS UNANIMOUSLY PASSED BY THE PROVIDENCE BOARD OF TRADE AT ITS MONTHLY MEETING HELD MAY 1, 1883.

Whereas the expenditures of the United States Government for the improvement of Narragansett Bay and the approaches to Providence Harbor have resulted in securing channels 25 feet deep at mean low-water, and with a least width of 200 feet; and

Whereas the present location of buoys in Narragansett Bay do not sufficiently mark these recently-completed channels: Therefore be it

Resolved, That the Providence Board of Trade hereby urgently petitions the honorable Secretary of the Treasury of the United States to have said new channels properly buoyed to enable mariners to readily distinguish them during the day, and also to cause said channels to be marked by a suitable series of range lights that they may be safely run during the night. And be it further

Resolved, That this Board of Trade particularly request the Senators and Representatives in Congress from this State to make every effort to secure for said channels these additional guards against the dangers of navigation.

CHAS. H. MERRIMAN,
President.

FREEMAN P. LITTLE,
Secretary.

It is expected that the present appropriation will be sufficient to secure something in excess of the 200 of the 300 feet of width projected for the 25-foot channel from Fox Point to the deep water of Narragansett Bay. The remaining width of this deep-water channel; the unexecuted portion of the approved project for an anchorage basin above Field's Point, and the proper enlargement of the channel below Field's Point to accommodate the wants of coasting and local traffic, should be provided for by early additional appropriations.

In the adopted project for the anchorage basin between Fox Point and Field's Point the bottom was to be of the following form in cross-section:

	Feet deep.
150 feet wide	23
600 feet wide	20
725 feet wide	18
940 feet wide	12
1,060 feet wide	6

This has been modified by the adoption of the project for a 25-foot channel, 300 feet wide, and the project for the basin above Field's Point now stands as follows:

	Feet deep.
300 feet wide	25
600 feet wide	20
725 feet wide	18
940 feet wide	12
1,060 feet wide	6

The estimated cost of the modified project, including the continuation of the 300-foot channel, 25 deep to deep water of Narragansett Bay, was $675,000.

Below Field's Point there has been no approved project of improvement other than that to secure a channel 300 feet wide and 25 feet deep, but from Sabin's light (the lower end of the Pawtuxet Channel) to Field's Point, the width of 300 feet will be insufficient to accommodate the increasing coasting and local traffic, and a plan has been prepared for an enlarged beating channel in this part of the river:

	Feet deep.
300 feet wide	25
500 feet wide	18
700 feet wide	14

With proper enlargements at the angles.

The estimated cost of this channel, excluding the cost of the 25-foot

channel now in progress, is $115,000, making an estimated total cost for the entire river $790,000. Of this amount there has been appropriated $355,000, leaving $435,000 as the amount necessary to complete the improvement.

Since the improvement of Providence River was commenced by Lieutenant Rosecrans, United States Engineers, in 1853, the navigable depth has been increased from 4½ to 25 feet at mean low-water.

During the fiscal year until the 6th of June this work was under the immediate supervision of Assistant Engineer H. A. Bentley, and since that date of Assistant Engineer J. P. Cotton.

Providence River is in the collection district of Providence, which is a port of entry. The amount of revenue collected during the last fiscal year was $286,443.80. The nearest light-houses are the six light-houses in Providence River. The nearest fortifications are fort on Dutch Island and Fort Adams, R. I.

Money statement.

July 1, 1882, amount available		$3,464 49
Amount appropriated by act passed August 2, 1882		125,000 00
		128,464 49
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$75,378 67	
July 1, 1883 outstanding liabilities	16,921 84	
		92,300 51
July 1, 1883, amount available		36,163 98
Amount (estimated) required for completion of existing project		320,000 00
Amount (estimated) required for additional work		115,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		150,000 00

LETTER OF THE PRESIDENT OF THE BOARD OF TRADE OF PROVIDENCE, RHODE ISLAND.

PROVIDENCE BOARD OF TRADE,
SECRETARY'S OFFICE,
Providence, R. I., June 5, 1883.

SIR: With this I have the honor to hand you some statistics of the port of Providence for the year 1882; also, copy of report made to me by Mr. C. H. Salisbury (the keeper of Pomham lights) of the number and character of vessels passing his light-house for several years. I send the report entire, as it will serve to illustrate the important fact that the increasing numbers of heavy-draught vessels, such as steamships and barges, has caused a decrease in the aggregate number of vessels entering the port. This is due in a great measure to the coaling business, which you will note by statistics attached is of great importance, and which formerly employed large numbers of small schooners and sloops, which are now being driven from the business by heavy-draught barges and three-masted schooners. This coaling business bids fair to increase largely in the near future, contracts having already been given out for better facilities for handling cargoes at our wharves.

It is difficult to give any statistics of the exports of this city. They are of great value, but consist largely of manufactures of iron, steel, cotton, wool, &c., and are shipped mainly by the steamship lines between this port and New York, Philadelphia, Baltimore, and Norfolk, which lines also transport large quantities of freight from the interior cities of New England, such as Worcester, Nashua, Lowell, and Lawrence. There are no means of getting at the actual value of these exports, but they undoubtedly would aggregate several hundreds of millions of dollars annually.

In pursuing a liberal policy of improvement in our bay and harbor the General Government is not merely fostering a local interest. The merchants of all sections of the country have an interest in the matter, for merchandise from every State in the Union here finds a market or an outlet.

If I can be of any further service to you I shall be pleased to receive your commands, and am,

Your obedient servant,

CHAS. H. MERRIMAN,
President.

GEO. H. ELLIOT,
Lieut. Col. of Engineers.

P. S.—On reviewing my letter, it occurs to me that you may regard the statement of the immense value of the exports of this port as an exaggerated one. The estimate is intended, however, to cover the coastwise trade, and as the census of 1880 gives the value of manufactured goods as follows—

Massachusetts	$631,000,000
Vermont	31,000,000
New Hampshire	74,000,000
Rhode Island	104,000,000
Total	840,000,000

and the railroad lines terminating in Providence tap the manufacturing centers of these States, and bring immense quantities of their goods to the freight lines here, it appears that my figures are not unreasonable.

Very respectfully,

C. H. MERRIMAN.

STATISTICS OF THE PORT OF PROVIDENCE FOR YEAR 1882.

Vessels arrived from foreign countries, ninety-four, of which nineteen were American vessels.

Coastwise arrivals	5,014

IMPORTS.

Lumber	feet	4,122,000
Shingles		6,111,000
Laths		10,866,000
Pickets		119,675
Potatoes	bushels	2,137
Salt	pounds	6,907,826
Logwood	do	3,944,000
Scrap iron	tons	3,474
Brimstone	do	1,244
Molasses	gallons	100,032
Cotton*	bales	189,526
Wool*	do	39,226
Flour*	barrels	15,685
Grain*	bushels	1,275,902
Coal	tons	829,613

TONNAGE OF THIS PORT DECEMBER 31, 1882.

	Tons.
122 sail vessels	15,538.81
25 steamers	20,701.10

This does not include the great quantities of manufactured goods of States south of us which come through this port on their way to Boston and Central New England.

LIST OF VESSELS, INCLUDING STEAMERS, PASSING POMHAM ROCK LIGHT (SUNRISE TO SUNSET) FROM DECEMBER 10, 1871, TO SEPTEMBER 30, 1882.

December, 1871	350
Year 1872	13,789
Year 1873	17,406
Year 1874	16,115
Year 1875	13,884
Year 1876	14,872
Year 1877	12,481
Year 1878	13,363
Year 1879	12,857
Year 1880	12,926
Year 1881	11,965
January 1 to September, 1882	9,071
Total	149,079

* These articles are also received very largely by railroad.

LETTER OF MR. GEORGE R. PHILLIPS.

PROVIDENCE, R. I., *June* 8, 1883.

DEAR SIR: With this I send you the commercial statistics of Providence for the year ending December 31, 1882, showing the imports of general merchandise, &c. which I hope will be satisfactory to you and give you the desired information.

* * * * * * *

Very truly, yours,

GEO. R. PHILLIPS.

Col. GEO. H. ELLIOT.

IMPORTS INTO THE PORT OF PROVIDENCE, RHODE ISLAND, FOR THE YEAR 1882.

Lumber	feet		24,520,980
Shingles			9,070,480
Pickets			1,611,655
Clapboards and laths			12,498,000
Bricks			22,000,000
Lime	casks		27,000
Cement	do		31,500
Coal	tons		821,837
Cotton	bales		237,983
Wool	do		100,434
Flour	barrels		258,085
Corn	bushels		1,658,091
Bran	do		893,097
Oats	do		460,064
Malt	do		133,247
Meal	do		6,865
Wheat and rye	do		6,624
Salt	do		90,000
Logwood	pounds		6,296,000
Brimstone	do		1,500
Iron:			
Scrap	tons	5,500	
Bar	do	16,000	
Pig	do	13,000	
			34,500
Molasses	hogsheads		14,000
Number of vessels arriving			5,094

NAMES OF STEAMERS RUNNING TO PROVIDENCE, AND DRAUGHT OF WATER.

	Draught, feet.
Wilkesbarre, carries 2,000 tons coal	22
Nianza, carries 1,800 tons iron	22
C. W. Lord, carries 900 tons coal	18½
Allentown, carries 1,900 tons coal	18
Redding, carries 1,850 tons coal	18
Pokomea, carries 1,400 tons coal	17
Kanawha, carries 850 tons coal	16
Panther, carries 1,000 tons coal	13
Centipede, carries 600 tons coal	12
Berks, carries 900 tons coal	13
Rattlesnake, carries 600 tons coal	12
Blackstone	15
George Appold	18
William Kennedy	15
William Lawrence	16
Alleghany	21
Berkshire	21
C. Whiting	15
Tonawanda	16
Electra	15
Stonington	12
Narragansett	12

SAIL VESSELS.

Balch, four-masted, carries 1,400 tons	16
Church, four-masted, carries 1,800 tons	17
Williams, three-masted, carries 1,400 tons	18
Lawrence, three-masted, carries 1,300 tons	16
Angell, three-masted, carries 1,310 tons	16
Phillips, three-masted, carries 1,300 tons	16
Briggs, carries 1,300 tons	16
Simmons, carries 1,200 tons	16
Walker, carries 1,260 tons	17

BARGES.

Cuba, carries 1,450 tons coal	18
Expounder, carries 1,400 tons coal	18½
Union, carries 1,440 tons coal	16½
Oceanic, carries 1,500 tons coal	17
Albemarle, carries 1,600 tons coal	17½
Hatteras, carries 1,600 tons coal	17

LETTER OF COLLECTOR OF CUSTOMS AT PROVIDENCE, RHODE ISLAND.

CUSTOM-HOUSE, PROVIDENCE, R. I.,
Collector's Office, June 16, 1883.

SIR: I forward herewith statistics of commerce and navigation in this district, as requested in your letter of the 22d ultimo.

Respectfully,

CYRUS HARRIS,
Collector.

GEO. H. ELLIOT,
Lieut. Col. of Engineers.

RIVER STATISTICS OF THE PORT OF PROVIDENCE FOR THE YEAR 1882.

Tonnage of one hundred and twenty-two sail vessels said to belong to the port		15,538.81
Twenty-five steamers said to belong to the port		20,701.10
Total		36,239.91
Number of vessels that arrived at this port (foreign, 164; coastwise, 5,034)		5,198
To this should be added the vessels of 5 tons and upwards, but under 20 tons, that are constantly arriving with cargoes, but are not reported, forty-nine in number; also the class of steamers that are towing barges here and are not reported. An average tow of barges is three, and as eight hundred and thirty-two barges arrived here for the year, we have as an estimate for these arrivals		277
Total		5,475

Tonnage of reported arrivals ascertained by taking an average month, the month of April, with four hundred and twenty-nine arrivals, and finding the tonnage for same on Merchant List, then multiplying by twelve, thereby getting an estimate for the year (100 cubic feet to the ton), 1,866,528.36 tons.

To this should be added the tonnage of the above class of 5 tons and under 20 tons, the aggregate of which, 394.56 tons, multiplied by the many times arrived; also the class of steamers arriving, fourteen in number, with barges, whose aggregate tonnage is 1,510 tons, multiplied by estimated times of arrival, 277 by 108 tons, average 29.916 tons.

CLASS OF VESSELS AND NUMBER OF EACH CLASS.

Steamers	1.876	Sloops	135
Barks	9	Barges	832
Barkentines	3		
Brigs	14	Total	5,198
Schooners	2,329		

ARRIVALS OF ALL KINDS FOR EACH MONTH.

January	286	August	573
February	259	September	406
March	422	October	498
April	429	November	414
May	544	December	349
June	501		
July	517	Total	5,198

(Add estimated arrivals not reported.)

MERCHANDISE RECEIVED AT THIS PORT, TOGETHER WITH THAT SHIPPED BY STEAMERS ONLY; ALSO PASSENGERS CARRIED AND DRAUGHT OF WATER.

Norfolk and Baltimore line:

Tons of freight, 71,868; passengers, ——.

	Tonnage.	Draught, feet.
Steamer Blackstone	1,147.19	19
Steamer Berkshire	2,014.42	20 to 22
Steamer Alleghany	2,014.42	20 to 22
Steamer Wm. Kennedy	974.57	17
	6,150,60	
Steamer George Appold	1,456.19	18
Steamer McClellan	953.42	16
Now running here	2,409.61	

Winsor's line:

Tons of freight	62,400
Passengers	None.

	Tonnage.	Draught, feet.
Steamer Catherine Whiting	880.63	15
Steamer Tonawanda	844.52	13

Providence line to New York, and return:

Tons of freight	438,000
Passengers	29,137

	Tonnage.	Draught, feet.
Steamer Massachusetts	2,606.83	12
Steamer Rhode Island	2,888.20	12
Steamer Electra	1,566.70	14 to 17
Steamer Doris	1,360.25	14 to 17
Steamer Galatea	1,566.70	14 to 17
Steamer Thetis	1,360.25	14 to 17
Steamer Amos C. Barstow	268.13	12
Steamer Frances	988.18	6
	12,605.24	

Continental Steamboat Company:

	Tonnage.	Draught, feet.
Steamer Crystal Wave	777.55	7½
Steamer Day Star	681.61	6½
Steamer Bay Queen	679.51	6½
Steamer City of Newport	561.73	6½
Steamer What Cheer	214.98	4½
	2,915.38	

Tons of freight	21,900
Passengers	377,330

Fall River line:

	Tonnage.	Draught, feet.
Steamer Richard Borden	892.35	7
Steamer Canonicus	510.67	6½
Steamer Bradford Durfee	388.43	6
	1,791.45	

Tons of freight	36,500
Passengers	103,734

Steamer William Marvel:

Tonnage, 8,654; draught, 6½ to 8½ feet.

Tons of freight	22,000
Passengers	4,800

Steamer George W. Danielson:

Tonnage, 130.76; draught, 7 to 9 feet.

Tons of freight	5,000
Passengers	8,912

DRAUGHT OF OTHER VESSELS ARRIVING AT THIS PORT.

1. A class of sail vessels from 150 to 300 tons capacity; draught, from 10 to 13 feet.
2. A class of sail vessels from 400 to 700 tons capacity; draught, from 12 to 14½ and 15 feet.
3. A class of sail vessels from 800 to 1,300 tons capacity; draught, from 15 to 17½ and 18 feet.
4. A class of barges that were formerly steamers and ships: Barge Cuba, 1,400 tons capacity; draught, 18 to 19 feet. Barge Expounder, 1,500 tons capacity; draught, 19 feet. Barge Hatteras, 1,400 tons capacity; draught, 16 to 17 feet. Barge Albemarle, 1,450 tons capacity; draught, 16 to 17 feet.
5. A class of steamers: Wilkesbarre, 2,200 tons capacity; draught, 21½ feet. Reading, Allentown, Pottsville, Yorktown, 1,800 tons capacity; all drawing about 18½ feet. C. W. Lord, 900 tons capacity; draught, 17 feet. Kanawha, 800 tons capacity; draught, 16½ feet. Also other large steamers.

KINDS OF MERCHANDISE RECEIVED BY SAIL VESSELS AND BARGES, NUMBER OF CARGOES OF EACH KIND, AND QUANTITY.

			Tons.
Domestic lumber, all kinds, one hundred and seventy-six cargoes			38,153
Foreign lumber, all kinds, one hundred and twenty-two cargoes			11,096
Coal received at this port			829,613
Coal arriving at this port, and thence by tow to Pawtucket			65,000
Brick, one hundred and twenty-six cargoes			14,555
Brick, for Pawtucket, arriving at this port first			2,500
Cement and lime, ninety-four cargoes, 93,213 barrels			19,484
Cement and lime, for Pawtucket as above, 3,300 barrels			442
Balance for Pawtucket shipped direct from this port.			
Pig-iron, one hundred and nineteen cargoes at this port			12,885
Pig-iron arrived for Pawtucket			1,200
Scrap iron from home ports, sixty-one cargoes			7,245
Scrap iron, foreign			3,474
Corn by sail vessels and barges, that arriving by steamers being accounted for in their aggregate, one hundred and sixty-four cargoes, 1,159,030 bushels			25,871
Oysters, one hundred and seventeen cargoes, 316,512 bushels			11,304
Molding sand, one hundred cargoes			13,605
Cotton, by sail vessels only, 21,865 bales			4,923
Salt, eighteen cargoes from home ports, 74,639 bushels			2,499
Salt, foreign, 92,104 bushels			3,083
Dye wood and chemicals from home ports, twenty-seven cargoes			2,991
Dye wood, foreign			1,760
Sulphur from home ports			373
Sulphur from foreign ports			1,244
Cotton-seed oil, four cargoes			2,682
Naphtha, four cargoes			954
Asphalt from home ports			500
Potatoes	bushels	2,137	
Oranges		19,000	
Bananas	bunches	4,679	
Coffee	pounds	2,450	estimated 600
Cocoa-nuts		40,300	
Butter	pounds	60	
Molasses	gallons	100,032	
Total			1,071,036

GENERAL MERCHANDISE RECEIVED BY STEAMERS.

	Tons.
Baltimore line	52,694
Winsor's line	31,200
New York line	219,000
Continental line	10,950
Fall River line	18,250
William Marvel line	11,000
George W. Danielson line	2,500
Total (2,240 pounds to the ton)	1,416,630

Tonnage of all vessels that arrived during the year that were reported	1,866,528
Freight and cargoes of all kinds	1,416,630
Total	449,898

This difference is about what it should be, as most of the steamers did not near reach their tonnage capacity in amount of freight carried, while to all said vessels and barges about one-third should be added for actual carrying capacity, as for instance:

	Tons.
Steamer Massachusetts	2,606.83
Steamer Rhode Island	2,888.20
Steamer Galatea	1,566.70
Steamer Electra	1,566.70
Each of them arriving on average ninety-one times a year—	
Bringing tons	219,000
Carrying do	219,000
Total do	438,000

Or 600 tons a day each way (2,240 pounds to the ton); while in case of barge Delaware, arriving February 1, 1882, with a cargo of 547 tons of coal, register tonnage 290.45, we have more than a half to add. Also schooner Charles A. Briggs, arrived February 25, 1882, with a cargo of 1,066 tons, register tonnage 757.93, here is one-third to add.

With this in view, probably this estimate will be found correct, or very nearly so.

Amount of merchandise shipped from this port, consisting of cotton and woolen goods of all kinds, machinery, stoves, furnaces, foundry facings, sewing-machines, files, screws and other manufactures of iron, oils, chemicals, leather, baking-powders, yeast-powders, stove polish, rags, &c.

Brick, lime, cement:	Tons.
Baltimore line	19,174
Winsor's line	31,200
New York line	109,500
Continental line	10,950
Fall River line	18,250
William Marvel line	11,000
George W. Danielson	2,500
Total	202,574
By sail vessel and barge:	
Cotton waste	80
Iron	1,000
Salt, 1,050 tons; barrels, 500 tons	1,550
Oyster-shells, 4,464 tons; wadding, 6 tons	4,470
Lime, cement, pig-iron, coal, and brick and lumber arriving at this port for Pawtucket, also same shipped direct from here, estimated	104,000
Total	313,674

About 1,000 tons a day for 313 days; nothing leaving here for Pawtucket Sunday; 2,240 pounds to the ton.

RECAPITULATION, WITH ADDITIONAL STATEMENTS FOR THE YEAR 1882.

Number of vessels arrived according to marine reports:	
Coastwise	5,034
Foreign	164
Steamers in tow of barges, and not in marine reports	277
Also vessels over 5 tons and under 20 tons	5,475

	Tons.
Tonnage of reported arrivals as per list of merchant vessels	1,866,528
Tonnage of steamers in tow of barges, and not in marine reports	29,916
Tonnage of vessels under 20 tons	
Total	1,896,444
Merchandise received	1,416,630
Add wire for American Screw Company	1,500
Iron water-pipe for city	419
Total	1,418,549

Tons of 2,240 pounds to the ton.

The product of several large brick kilns, amounting to thousands of tons, and owned by parties doing business here, that are carried by scows to this city, Pawtucket, and other places on the river and bay, I have made no estimate of.

Steamer Nyanza, from London, arrived at this port December 18, 1882; draught 21½ feet.

Number of passengers on steamers, 519,113.

C 8.

IMPROVEMENT OF NEWPORT HARBOR, RHODE ISLAND.

At the date of the last annual report dredging under the appropriation of $25,000 by act of Congress approved March 3, 1881, was in progress. Mr. Edgar M. Payn, the contractor, completed his contract October 24, 1882, having removed 56,860 cubic yards in addition to the quantity reported in the last annual report as removed in the preceding fiscal year. The entire improvement under the Payn contract was in that part of the harbor which lies between Long Wharf and Commercial Wharf.

By act of Congress of August 2, 1882, $20,000 was appropriated for this harbor, and Maj. J. W. Barlow, in temporary charge after the death of General Warren (August 8, 1882), advertised on the 26th of September, 1882, for proposals for dredging to 13 feet at mean low-water; two-thirds of the total quantity to be removed from the area between the harbor line, the curve of 13 feet depth, Long Wharf and Lime Rock, and the remaining one-third to be taken from the spit at the south end of Goat Island. The following proposals were received, and were opened October 20, 1882:

Names and addresses of bidders.	Price.	Date of commencement.	Date of completion.
	Per cu. yd.		
J. H. Fenner, Jersey City, N. J	$0 24½	Nov. 10, 1882	June 30, 1883
James Caler & Son, Norfolk, Va	24½	Mar. 5, 1883	Sept. 1, 1883
W. H. Beard, Brooklyn, N. Y	26½	Nov. 10, 1882	June 30, 1883
Elijah Brainard, New York, N. Y	27	July 1, 1883	Dec. 1, 1883
S. A. Hammond, Providence, R. I	34¾	Nov. 10, 1882	June 30, 1883
E. H. Payn, Albany, N. Y	34¾	Nov. 10, 1882	June 30, 1883

The lowest price (24½ cents) being named by two of the bidders, Mr. J. H. Fenner and James Caler & Son, the contract, with the approval of the Chief of Engineers, was awarded to the former, who proposed to commence and finish the work sooner than the latter; date of contract October 30, 1882.

On the 24th November, 1882, the work, by direction of the Chief of Engineers, was transferred to Lieut. Col. George H. Elliot, Corps of

Engineers. Mr. Fenner had commenced work under the above contract November 13, 1882, and the work of dredging in the inner harbor, as limited by the contract, was completed April 24, 1883. The dredging machine was then removed to the spit south of Goat Island, and work there was continued until June 20, 1883, when the contract was completed. The total quantity of material excavated during the last fiscal year under this contract was 73,535 yards.

The anchorage capacity of the inner harbor has been increased during the year about ten acres; and the entrance way between Lime Rock and Goat Island, with a minimum depth of 13 feet at mean low-water, has been increased 250 feet in width, which required dredging over an area of 4.6 acres.

The estimated cost of the project under which the improvement of Newport Harbor is carried on was $132,000. This should be increased by the amount of $6,000 required for additional jetties on the west side of Goat Island to arrest the drift of gravel and sand into the south entrance to the harbor.

There has been appropriated $45,000, leaving to be provided $93,000. This harbor is sheltered from every wind. It is much used by coasters and fishing vessels as a harbor of refuge, and in summer it is a favorite rendezvous for yachts. In the fishing season it is not unusual to see from one hundred and fifty to two hundred sail at anchor here in the approach of a storm. It is also prospectively of great importance as a military and naval station in the event of foreign war.

During the fiscal year, until the 6th of June, 1883, this work was under the immediate supervision of Assistant Engineer H. A. Bentley, and since that date, of Assistant Engineer J. P. Cotton.

Newport is in the collection district of Newport, and is a port of entry. The amount of revenue collected in the last fiscal year was $3,133.71. The nearest light-houses are Lime Rock and Newport (Goat Island) lights.

The nearest fortification is Fort Adams, Newport, R. I.

Money statement.

July 1, 1882, amount available		$8,041 05
Amount appropriated by act passed August 2, 1882		20,000 00
		28,041 05
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$23,552 24	
July 1, 1883, outstanding liabilities	4,130 04	
		27,682 28
July 1, 1883, amount available		358 77
Amount (estimated) required for completion of existing project		87,000 00
Amount (estimated) required for additional work		6,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		50,000 00

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, NEWPORT, R. I.,
Collector's Office, July 26, 1883.

SIR: I have to acknowledge the receipt of your letters of May 22 and July 19, 1883. I am unable to furnish you statements in detail of the staple articles referred to that have been received in this district, as only vessels from a foreign port or those having dutiable cargoes make any report at this office.

During the year ending June 30, 1883, some five thousand vessels of all classes have come into this port either for a harbor or to discharge their cargoes. This includes

steam and sail vessels, and those engaged in the coasting trade or fisheries, and yachts. The average draught of water of the coasting vessels is 9 feet.

During the year ending June 30, 1883, seven vessels entered this port from foreign ports, and discharged their cargoes here. Nine vessels cleared from this port for foreign ports, two of them carrying full cargoes.

The cargoes from foreign ports consisted of 168,415 feet spruce board, dutiable; 334,135 feet spruce board, produce of State of Maine; 189,000 feet hemlock board, produce of State of Maine; 650,700 feet spruce laths, produce of State of Maine.

The cargoes shipped from this port for foreign ports consisted of 535 tons fish guano, valued at $15,515; 1,121 bundles wood hoops, valued at $819.35.

During the year ending June 30, 1863, there has been, say, 35,000 tons of coal discharged at the wharves of this port. There has also been received at this port, say, 3,000,000 shingles, 2,000,000 laths, 7,000,000 feet of lumber, 7,000 barrels of lime, 3,000 barrels of cement, and 2,500,000 brick.

The amount of revenue collected in this district for the year ending June 30, 1883, is as follows:

Duties on imports	$590 81
Marine-hospital tax	871 83
Inspection of steam vessels	543 70
Miscellaneous customs receipts	1,127 37
Total	3,133 71

There are one hundred and twenty-three vessels licensed and enrolled in this district, twelve steam and one hundred and eleven sail, the gross tonnage of which is 4,677.96 tons. The tonnage of the largest vessel is 367.03. The tonnage of the smallest vessel is 5.09. The largest vessel draws 13 feet of water when loaded.

These are all the statistics that occur to me. Should you require others, will try and obtain them.

Respectfully,

J. H. COZZENS,
Collector.

Lieut. Col. G. H. ELLIOT,
Engineer Office, U. S. A.

LETTER OF THE OLD COLONY STEAMBOAT COMPANY.

OLD COLONY STEAMBOAT COMPANY,
Newport, R. I., August 20, 1883.

SIR: I am in receipt of your letter of the 14th July, 1883, citing certain requirements of the Secretary of War relative to commerce and navigation, and asking me to furnish you with the aggregate amount of freight and passengers to, from, and through this harbor (Newport) by the steamers of the Old Colony Steamboat Company during the year 1882, and also such information as I may have respecting present condition of the harbor.

I respectfully submit the amount of freight carried by the steamers of this line to, from, and through this harbor during the year to be 241,750 tons, and the number of passengers to be 261,237.

I would respectfully represent that, inasmuch as the steamers of this line have been frequently detained in the channel between Lime Rock and Goat Island at low tide, drawing 13 feet of water, that an additional 2 feet or a total depth of 15 feet is necessary at all times to meet the requirements of the draught of water of the steamers of this line.

The depth of water in channel, as indicated on chart at mean low-water, is 13 feet. But inasmuch as there are times, particularly in stormy weather, that there would be, instead of 13 feet as marked on chart, but 12 feet of water, scant, in midchannel, I would suggest dredging the channel until a depth of 15 feet is obtained below your present low-water mark. This would insure plenty of water at all times of tides for vessels drawing 13 feet to pass through. Any of the steamers of this line with an ordinary load will ground in present channel at extreme low-water.

GEORGE PEIRCE,
Supervisor Old Colony Steamboat Company.

GEO. H. ELLIOT,
Lieut. Col. of Engineers, U. S. A.

C 9.

IMPROVEMENT OF BLOCK ISLAND HARBOR, RHODE ISLAND.

At the date of the last annual report no work was in progress.

By act of Congress of August 2, 1882, there was appropriated $19,000 for this work.

After the death of General Warren (August 8, 1882) the work was temporarily in charge of Maj. J. W. Barlow, Corps of Engineers, until the 24th of November, 1882, when, by direction of the Secretary of War, it was transferred to Lieut. Col. George H. Elliot, Corps of Engineers.

A project for the expenditure of the appropriation was submitted January 16, 1883. This project contemplated the erection of a harbor wall on the east side of the Inner Harbor, to serve in lieu of the crib-work filled with stone which has heretofore protected the Inner Harbor on that side, but which was intended only as a temporary structure, and the building of a jetty to protect the harbor from the material which was washed through the breakwater from the undermining of the cliffs to the southward and eastward. This was proposed to be done by the alternative plans of building a long jetty of riprap out to Lantern Rock and a shorter jetty of the same material running out from the shore under the cliffs. The latter plan was approved by the Chief of Engineers, and on the 14th of February, 1883, advertisements were issued inviting proposals. The following bids were received and were opened on the 17th of March, 1883:

Names and addresses of bidders.	Price per ton for riprap granite.	Price per cubic yard of wall.	Price per pile for foundation.
Charles H. Edwards, Boston, Mass	$1 89	$17 89	$14 00
James Scully, Groton, Conn	2 20	13 60	8 00
F. K. Ballou, Mystic Bridge, Conn	2 19	18 55	14 88
John Beattie, Leete's Island, Conn	2 50	20 75	21 00
Thomas A. Rowe and Robert G. Sylvester, Boston, Mass	2 97	16 50	10 00
Edward S. Paine, Block Island, R. I	2 09	.....	.....
Hiram A. Ball, Block Island, R. I	2 23	.....	.....
Charles T. Dery and James Burr, Boston, Mass	.....	16 29	10 00
Hiram W. Phillips, Quincy, Mass	.....	18 90	16 80

With the approval of the Chief of Engineers the contract for furnishing riprap granite for the jetty was awarded to Mr. Charles H. Edwards, the lowest bidder for the riprap granite, and the contract for building the harbor wall was awarded to James Scully, the lowest bidder for the wall.

Abstract of contracts.

Contractors and place of business.	Date of contract.	Subject of contract.	Price.	Date of commencement.	Date of completion.
Charles H. Edwards, Boston, Mass.	Mar. 26, 1883	Furnishing riprap granite for jetty.	$1.89 per ton of of 2,240 pounds of riprap.	Apr. 10, 1883	June 30, 1883
James Scully, Groton, Conn.	Mar. 26, 1883	Building harbor wall.	$13.60 per cubic yard of wall; $8 per pile for foundation.	Apr. 10, 1883	Aug. 15, 1883

The building of the jetty, by authority of the Chief of Engineers, has been done by hired labor. The granite riprap was furnished by the contractor by means of splitting up the large bowlders which are found on Block Island.

The jetty, which is to be about 150 feet in length, with a head or T 100 feet in length, is still in progress.

The harbor wall is of granite in courses. It is 287 feet long, 8 feet wide at the bottom for about 187 feet from the outer end, and 6 feet wide at the bottom for the remainder. It is 8½ feet high and 6 feet wide at the top throughout. It is partly founded on piles, sawed off below low water, and partly on a riprap foundation. The progress made by the contractor for the harbor wall is not altogether satisfactory, but it is hoped the contract will be completed in the time agreed on. Some minor repairs to the Government wharf on the south side of the inner harbor have been made, and the wharf on the west side, which had become so much decayed as to be dangerous, has been torn down.

The timber crib-work which protects the inner harbor on the west and north sides should also be replaced by walls of stone, as they are much decayed and liable to destruction in heavy storms. The south wharf (of wood), at which the freight shipped to and from the island, the United States mails, and the supplies for the light-houses on the island are landed, should be replaced by a retaining wall with earthen filling behind it. The estimated cost of these works is $30,000.

The further sum of $35,000 could be advantageously expended in the next fiscal year in the extension of the breakwater to secure additional shelter, and in that way relieve the inner harbor, which at times is too small to hold the vessels which seek it for refuge.

During the fiscal year this improvement has been under the immediate supervision of Assistant Engineer J. P. Cotton.

Block Island is in the Newport collection district, and Newport is the nearest port of entry. There is no duty collected at the island. The value of the harbor is mainly as a harbor of refuge for coasting vessels. There are three light-houses on the island, the North and South lights and the Breakwater light. The nearest fortification is Fort Adams, Newport, R. I.

Money statement.

July 1, 1882, amount available		$65 14
Amount appropriated by act passed August 2, 1882		19,000 00
		19,065 14
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,244 85	
July 1, 1883, outstanding liabilities	1,716 62	
		4,961 47
July 1, 1883, amount available		14,103 67
Amount (estimated) required for additional work		65,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		65,000 00

COMMERCIAL STATISTICS.

BLOCK ISLAND, R. I., *June* 11, 1883.

DEAR SIR: In compliance with your request by letter under date of the 22d ultimo, I send you herewith such facts in relation to the same as I am able to produce, hoping they may be of value to you.

Coal	tons..	2,500
Iron	do...	75
Grain	bushels..	60,000
Lumber	feet..	2,000,000
General merchandise shipped and received	tons..	150,000

Arrival and departure of steam vessels, 1,200, varying from 50 to 1,000 tons and drawing from 3 to 10 feet.

* * * * * * *

I am, yours very truly,

NICHOLAS BALL.

GEO. H. ELLIOT, Esq.

C 10.

IMPROVEMENT OF LITTLE NARRAGANSETT BAY, RHODE ISLAND AND CONNECTICUT.

At the date of the last annual report no work was in progress.

By the act of Congress of August 2, 1882, $6,000 was appropriated for this improvement, and Maj. J. W. Barlow, Corps of Engineers, in temporary charge after the death of General Warren (August 8, 1882), advertised on the 16th of September, 1882, for proposals for widening the channel made by former appropriations, from Pawcatuck Point to the deep water, to the west, making a depth of 7½ feet at mean low-water.

The following proposals were received and were opened October 10, 1882:

Names and addresses of bidders.	Price.	Date of completion.
	Per cu. yd.	
Hartford Dredging Company, Hartford, Conn	$0.20 9/10	June 30, 1883
J. H. Fenner, Jersey City, N. J	29 7/8	June 30, 1883

The contract, with the approval of the Chief of Engineers, was awarded to the Hartford Dredging Company, the lowest bidder; date of contract October 30, 1882.

On the 24th of November, 1882, the work, by direction of the Secretary of War, was transferred to Lieut. Col. George H. Elliot, Corps of Engineers.

Dredging under the above contract had been commenced November 17, 1882, and it was continued until December 1, 1882, when the tug-boat was frozen in and the work was suspended for the winter. It was resumed April 7, 1883, and prosecuted to May 26, 1883, 20,867 cubic yards having been removed, completing the original project for a channel through the bay 200 feet wide, except for a short distance opposite Pawcatuck Point, where some rocky material, not included in the contract, was encountered. This was subsequently removed by days' work.

There is remaining a considerable number of bowlders of various sizes in the bottom and on the sides of the dredged channel, and also in the channel at Watch Hill Landing, which will be removed later in the season, as soon as it can be done without interfering with the summer use of the channel by steamers. This work will be executed with the remainder of the appropriation, and will complete the improvement of Little Narragansett Bay as far as projected. The completed channel, for which good ranges on shore should be provided, will enable steamboats and vessels drawing from 9 to 10 feet, bound for Pawcatuck River and Westerly and also to Watch Hill, to cross the bay at any stage of the tide, and they can now take advantage of the improvement made by the general government in the Pawcatuck River.

Up to the 6th of June, 1883, this work was under the immediate supervision of Assistant Engineer H. A. Bentley.

Little Narragansett Bay is in the collection district of Providence and Stonington, the dividing line passing through the bay. Providence and Stonington are the nearest ports of entry. The revenue collected in the last fiscal year was: Providence, $286,443.90; Stonington, $2,328.31. The nearest light-houses are the Stonington and Watch Hill lights. The nearest fortification is Fort Trumbull, New London, Conn.

Money statement.

July 1, 1882, amount available		$277 88
Amount appropriated by act passed August 2, 1882		6,000 00
		6,277 88
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$4,942 84	
July 1, 1883, outstanding liabilities	199 20	
		5,142 04
July 1, 1883, amount available		1,135 84

COMMERCIAL STATISTICS.

LETTER OF MESSRS. RANDOLPH BENTLEY & CO.

WESTERLY, R. I., *June* 5, 1883.

DEAR SIR: In compliance with request in your inclosure of 22d ultimo, we have collected from what we consider authentic sources the following statistics in relation to commerce on Pawcatuck River and Little Narragansett Bay during the year 1882:

Coal brought to Westerly	tons..	17,729
Iron brought to Westerly	do...	820
Grain brought to Westerly	bushels..	47,800
Lumber brought to Westerly	feet..	4,150,000
Moulding sand brought to Westerly	tons..	282
Brick brought to Westerly		538,000
Stone shipped from Westerly	tons..	6,010
Steam barges arrived at Westerly		10
Vessels towed to Westerly		217
Vessels discharged at Stonington and cargoes brought on lighters to Westerly		39

Character of vessels, mostly schooners; tonnage of vessels, 150 to 200; draught of vessels, average 7 feet.

One steamboat made four daily trips between Westerly and Watch Hill during summer season. One small steamer made several daily trips between Watch Hill and Stonington during summer season.

Passengers carried on Pawcatuck River about 40,000; on Narragansett Bay, unknown, but estimated as about 30,000.

Any further information which you may suggest we shall be happy to obtain if possible.

We have the honor to remain, yours most respectfully,

RANDOLPH BENTLEY & CO.

Lieut. Col. GEORGE H. ELLIOT,
Corps of Engineers, U. S. A.

LETTER OF MESSRS. MAXSON & CO.

WESTERLY, R. I., *June* 10, 1883.

SIR: In reply to your communication of May 22, we beg to state that we have given the matter contained therein as much attention and thorough investigation as our limited time would allow, as we are very busy indeed just at this season. We have been informed from other sources that Messrs. Randolph, Bentley & Co. and G. B. & J. H. Utter were also looking up the same thing, but not wishing to interfere in any way with what you may have received from them, we take pleasure in remitting such facts as we have been able to collect. We have visited some of the mills, quarries, grain and coal dealers, foundries, &c., for facts. We present first some facts given by the captain of our tug-boat (Capt. William Greenman), which facts we presume also Messrs. Randolph, Bentley & Co. have or will give you, viz: There have been received in 1882 up our river 15,619 tons of coal by sailing vessels, 2,210 tons by steam vessels; total, 17,829 tons; 4,372,720 feet of lumber, *all* discharged at Stonington and lightered up our river; 415,000 bricks; 23,900 bags (2 bushels each) of grain; 820 tons iron; about 400 tons sand; 6,010 tons stone sent out of river.

There have been towed up and down our river two hundred and fourteen loaded vessels, besides numerous lighters and smaller craft which sailed. There have been

discharged in Stonington thirty-five vessels, being unable to get up here on account of insufficient depth of water. The above all came by water.

We append below a very few facts in relation to what came by cars which would have come by water had we 9 or 10 feet of water, viz: About 1,200 tons of cotton, 2,000 tons of coal, and 3,000 tons of wool, lime, lumber, cement, grain, &c.

We tried to ascertain the amount of business done by the principal business firms here, but find them mostly unwilling to give statistics in relation thereto, but we can figure it up easily to quite a number of millions dollars.

Many mills, quarries, &c., ship by railroad, because they cannot do otherwise. Several years ago the business men of Westerly met for the purpose of establishing a freight line between Westerly and New York, if it seemed practicable, which project was finally discarded, because of insufficient depth of water. We are laboring under a great disadvantage here by reason of having no competing line. The Stonington Steamship Company and our railroad charge us just what they please, and we cannot help ourselves. We have to pay more by 30 to 50 per cent. from New York to Westerly than the rate from New York to Boston. Boston rate, 18 cents; Westerly, 25 cents. The receipts at our depot are about $1,000 per week.

All lumber for Westerly has to be handled over in Stonington, thus injuring it very much, aside from the extra expense of transportation or lightering. The same to some extent with coal, but not so much. We find it extremely difficult—almost impossible—to charter light-draught vessels for lumber to come over the shoals, hence our great expense in lightering lumber.

We wish you could make it convenient to come here and look the ground over, as we believe you would find it a field worthy of an outlay. The question of deeper water here is one of vital importance to the business interests of Westerly, and could you make it convenient to come here we should take pleasure in showing you over the ground.

Trusting that these few facts, though incomplete, may be of service to you,

We are, very respectfully, yours,

MAXSON & CO.

GEO. H. ELLIOT,
Lieut. Col. of Engineers.

N. B.—We failed to mention the fact that between 40,000 and 50,000 passengers were carried on our short river last year. Much of the commerce credited to Stonington really belongs to Westerly, as we cannot get nearer with large vessels.

C 11.

IMPROVEMENT OF STONINGTON HARBOR, CONNECTICUT.

At the date of the last annual report no work was in progress.

By act of Congress of August 2, 1882, $25,000 was appropriated for continuing the improvement, and Maj. J. W. Barlow, Corps of Engineers, the officer in charge, advertised on the 28th of August, 1882, for proposals for continuing the construction of the breakwater on the line from the north end of the Middle Ground to the south end of Bartlett's Reef.

The following proposals were received and were opened September 27, 1882:

Names and addresses of bidders.	Price.	Date of completion.
	Per ton of 2,240 lbs.	
C. T. Derry & Co., Boston, Mass	$1 51	June 30, 1883
Thomas A. Rowe, South Boston, Mass	1 47	June 30, 1883
Chas. F. Stoll, New London, Conn	1 35	June 30, 1883
Fred. K. Ballou, Boston, Mass	1 09 9/10	June 30, 1883
John A. Bouker, Jersey City, N. J	1 11	June 30, 1883
*Thomas A. Scott, New Londen, Conn	1 10 3/8	June 30, 1883

*This bid was not considered. It was not received until after the hour appointed, and the other bids had been opened.

The contract, with the approval of the Chief of Engineers, was awarded to F. K. Ballou, the lowest bidder; date of contract October 18, 1882.

Mr. Ballou commenced work under his contract on the 21st of October, 1882, and continued during the winter with several interruptions on account of storms.

On the 27th of March, 1883, by direction of the Chief of Engineers, Major Barlow transferred the work to Lieut. Col. George H. Elliot, Corps of Engineers.

Up to this date the work of extension of the breakwater had been entirely on the east end, it having been found that the heavy seas which rolled in around this end would make it necessary to extend the breakwater eastward to Bartlett's Reef. The extension in this direction was continued till early in June, 1883, when work was commenced on the western extension towards the Middle Ground, and it has continued in the latter direction since, with the exception of some work at "topping-out" at the east end.

The length built during the year was 451 feet, of which 406 feet were at the east end and 45 feet were at the west end. The total length of the breakwater at the end of the fiscal year was 1,521 feet. The east end is now about complete, but the exact position in which to leave it cannot be determined until a survey has been made. The total number of tons of stone delivered during the year was 16,413.

With the approval of the Chief of Engineers, the time for the completion of the existing contract has been extended to September 30, 1883.

In order to carry the breakwater to the Middle Ground, there yet remains to be constructed about 850 running feet.

The original estimate of the cost of the work was $100,000. In the last annual report Major Barlow estimated the additional cost of the breakwater, by its extension eastward to Bartlett's Reef, at $30,000, making an estimated total cost of $130,000. Of this sum there has been appropriated $80,000, leaving $50,000 as necessary to complete.

During the fiscal year the work was under the immediate supervision of Assistant Engineer Wm. W. Star, jr., until the middle of April, 1883, and from that date until June 6, 1883, of Assistant Engineer H. A. Bentley.

Stonington Harbor is in the Stonington collection district, and is a port of entry The amount of revenue collected in the last fiscal year was $2,328.36. The nearest lights are Stonington light and Eel Grass Shoal light-ship. The nearest fortification is Fort Trumbull, New London, Conn.

Money statement.

July 1, 1882, amount available		$680 44
Amount appropriated by act passed August 2, 1882		25,000 00
		25,680 44
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$15.540 46	
July 1, 1883, outstanding liabilities	4,025 36	
		19,565 82
July 1, 1883, amount available		6,114 62
Amount (estimated) required for completion of existing project		50,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		50,000 00

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, STONINGTON, CONN.,
Collector's Office, June 4, 1883.

DEAR SIR: In reply to your favor of May 22, I herewith respectfully furnish commercial statistics for this port:

Number of vessels entered from foreign ports	3
Number of vessels cleared for foreign ports	2
Value of merchandise imported	$648 85
Amount of duties collected	198 68
Hospital dues collected	1,014 37
Miscellaneous items	1,115 31
Entrance and clearance coastwise steamers	710
Entrance and clearance coastwise sailing vessels	10

ESTIMATED VALUE OF CARGOES OF VESSELS ENTERED AND CLEARED COASTWISE.

Received	$32,740,500
Shipped	29,670,450
Value of product of fisheries	169,290
Number of vessels seeking harbor for refuge	2,500
Number of vessels registered in Stonington district	107
Tonnage of vessels registered in Stonington district	8,302.23

ESTIMATED TONNAGE OF FREIGHT RECEIVED AND FORWARDED FROM THE WHARF OF THE STONINGTON STEAMBOAT COMPANY FOR THE YEAR ENDING DECEMBER 31, 1882.

By regular boats of Stonington line	420,500
By extra boats	49,800
By occasional boats loading and discharging	70,000

H. N. TRUMBULL,
Collector.

HON. GEORGE H. ELLIOT,
Lieut. Col. of Engineers, U. S. A.

Return of vessels which have passed by or in vicinity of the light vessel at Eel Grass Shoal during the year ending June 30, 1883.

1883.	Ships.	Barks.	Brigs.	Schooners.	Sloops.	Steamers.	Total.
Quarter year ending—							
September 30	3	13	22	4,757	1,265	1,778	7,838
December 31	4	14	19	3,337	481	1,423	5,278
March 31	3	3	.....	1,257	232	891	2,386
June 30	1	3	14	3,519	796	1,299	5,632
Total	11	33	55	12,870	2,774	5,391	21,134

Very respectfully,

CHARLES E. P. NOYES,
Principal Light-keeper.

GEO. H. ELLIOT,
Lieut. Col. of Engineers, U. S. A.

APPENDIX D.

IMPROVEMENT OF HARBORS AND RIVERS ON LONG ISLAND SOUND.

REPORT OF MAJOR WALTER McFARLAND, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1883, *WITH OTHER DOCUMENTS RELATING TO THE WORK.*

IMPROVEMENTS.

1. Thames River, Connecticut.
2. New London Harbor, Connecticut.
3. Connecticut River, Massachusetts and Connecticut.
4. Clinton Harbor, Connecticut.
5. New Haven Harbor, Connecticut.
6. Breakwater at New Haven, Connecticut.
7. Milford Harbor, Connecticut.
8. Housatonic River, Connecticut.
9. Bridgeport Harbor, Connecticut.
10. Southport Harbor, Connecticut.
11. Norwalk Harbor, Connecticut.
12. Mamaroneck Harbor, New York.
13. Port Jefferson Harbor, New York.
14. Greenport Harbor, New York.

ENGINEER OFFICE, UNITED STATES ARMY,
New London, Conn., August 4, 1883.

GENERAL: I have the honor to transmit herewith my annual reports upon the river and harbor works in my charge for the fiscal year ending June 30, 1883.

Very respectfully, your obedient servant,

WALTER McFARLAND,
Major of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

D 1.

IMPROVEMENT OF THAMES RIVER, CONNECTICUT.

The improvement of this river has been confined to a section extending 3 miles below the city of Norwich. It was begun in 1836 by the construction of piers and dredging, with the object of making and maintaining a depth of 14 feet at mean high water in a channel 100 feet wide. The desired depth and width were secured in 1873, but the shoals formed again in about the same places, and in 1878 further appropriations were made for their removal, and the project was modified so as to increase the depth sought from 14 feet at high water to 14 feet at low water, a difference of about 3 feet. In 1882 the plan of operations was modified, and a system of longitudinal training-walls extending along the outside of the channel curves was adopted, to be supplemented, if found necessary, by low walls on the inner side of the curves. This was not expected to materially diminish the amount of dredging required, but to make the depth permanent when once obtained. The projected width was also increased to 200 feet.

At the date of the last annual report, proposals for continuing the construction of the Trading Cove dike and for dredging had been received.

July 5, a contract was entered into with Frederick K. Ballou, of Boston, Mass., to continue work on the dike at the rate of $1.25 per ton for riprap stone. Work was begun July 10, and completed October 17, 1882, 10,612 tons of stone being placed in the dike, building 1,620 linear feet of work. Under a previous contract 6,595 tons of stone had been delivered, building 750 feet of the dike. The total length of the completed wall is 2,370 feet, and it contains 17,207 tons of riprap stone. It has a width on top of from 2 to 3 feet, with side slopes of 45 degrees, and rises to high-water level, except for 400 feet at the north end, where the top slopes down to 1 foot above low-water level. It was thought that this slope would give a better direction to the currents from Trading Cove.

July 15, 1882, a contract was made with the Hartford Dredging Company, of Hartford, Conn., to dredge at the rate of $14\frac{3}{8}$ cents per yard, the lowest bid, that of Frank Pidgeon, jr., of New York, N.Y., being rejected by order of the Chief of Engineers. Work was begun July 20, suspended during the winter, resumed May 23, 1883, and is now in progress under an extension of the contract to October 1, 1883. During the year 42,932 cubic yards of sand have been removed from the channel at and below Thamesville, making a depth of 14 feet at mean low water in a channel 100 feet wide, extending from deep water opposite the upper Rolling Mill to the Sand Pier; and 10,265 cubic yards from in front of Trading Cove, making 14 feet depth in a channel 620 feet long and 60 feet wide, with an additional 960 feet of 40 feet wide. Work at this place is being continued.

Under an appropriation of $35,000, made by act of Congress passed August 2, 1882, proposals for constructing a dike opposite Mohegan were opened September 27, 1882, the dike to be built either of piles and stone or wholly of stone. The lowest bid was that of Frederick K. Ballou, of Boston, Mass., for a pile and stone dike, at the rate of $8 per linear foot, and a contract, dated October 18, 1882, was made accordingly. Work was not begun until May 1, 1883. At the close of the fiscal year several hundred feet of the work were in various stages of progress, but no part of it had been fully completed. The contract has been extended to October 30, 1883.

The system of training-walls ought to be pushed on to completion as rapidly as possible. One hundred thousand dollars could be advantageously expended in this work and in dredging during the year ending June 30, 1885.

Appropriations for the improvement of Thames River have been made and expended as follows, viz:

Date.	Amount.	Application.
March 3, 1821	$150	Removal of obstructions placed during war of 1812.
March 2, 1829	150	Survey.
July 4, 1836	10,000	Piers and dredging.
March 3, 1837	20,000	Do.
July 7, 1838	10,000	Do.
June 23, 1866	10,000	Dredging and survey.
March 3, 1867	72,000	Dredging.
March 3, 1871	15,000	Do.
June 10, 1872	10,000	Do.
June 18, 1878	10,000	Do.
March 3, 1879	12,000	Do.
June 14, 1880	22,500	Dredging and training-walls.
March 3, 1881	30,000	Do.
August 2, 1882	35,000	Training-walls (not expended).
Total	256,800	

Thames River is in the collection district of New London. The nearest light-house is at the mouth of the river on the west shore. Forts Trumbull and Griswold overlook the mouth of the river from either shore.

Money statement.

July 1, 1882, amount available		$28,974 72
Amount appropriated by act passed August 2, 1882		35,000 50
		63,974 72
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$21,438 40	
July 1, 1883, outstanding liabilities	2,114 66	
		23,553 06
July 1, 1883, amount available		40,421 66
Amount (estimated) required for completion of existing project		153,080 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		100,000 00

Abstract of proposals opened September 27, 1882, for construction of dike in Thames River, Connecticut.

No.	Names and addresses.	Price for stone dike.	Price per pile and stone dike.	Date of commencement.	Date of completion.
		Per ton.	*Per foot.*		
1	*C. T. Deny & Co., Boston, Mass	$1 35	.....	No date.....	June 30, 1883
2	Frank Pidgeon, jr., New York	.....	$8 74	....do	June 30, 1883
3	*Frederick K. Ballou, Boston, Mass	1 19 9/10	8 00	....do	June 30, 1883
4	Gunn & Ingerson, Woonsocket, R. I., Brattleborough, Vt.	.....	8 14	....do	June 30, 1883
5	Stephen A. Kelly, Brooklyn, N. Y	.....	9 70	....do	June 30, 1883
6	James Scully, Groton, Conn	1 14	.....	....do	June 30, 1883

*Bidder's bond not complete. Signature not witnessed.

Abstract of contracts for improving Thames River, Connecticut, in force during the fiscal year ending June 30, 1883.

Names and addresses of contractors.	Date of contract.	Subject of contract.	Price.	Remarks.
Frederick K. Ballou, Boston, Mass.	July 5, 1882	Constructing stone dike.	$1.25 per ton ..	Contract completed October 17, 1882.
The Hartford Dredging Company, Hartford, Conn.	July 15, 1882	Dredging	$0.14⅜ per cubic yard.	Contract extended to October 1, 1883.
Frederick K. Ballou, Boston, Mass.	Oct. 18, 1882	Constructing pile and stone dike.	$8 per linear foot.	Contract extended to October 30, 1883.

COMMERCIAL STATISTICS.

The following statement of the commerce of the Thames River, above New London, for the fiscal year ending June 30, 1883, is obtained from the several companies engaged in freighting on the river:

	Tons.
Thames Towing Company, estimate from company's books	300,000
Norwich and New York Transportation Company:	
One steamer each way per day, for 300 days, average freight of 300 tons	180,000
Steamer Delaware, forty trips each way, average freight of 200 tons	16,000
Other towing companies, estimated at	84,000
Sailing vessels not towed, about	20,000
Total	600,000

D 2.

IMPROVEMENT OF NEW LONDON HARBOR, CONNECTICUT.

The original project for work in this harbor, submitted in June, 1880, contemplated the removal of the southern part of the shoal east of the New London Northern Railroad wharf, as far as a line running east and west 500 feet north of the south end of the wharf. This plan was subsequently changed so as to make the limit extend about 100 feet further north to a line running in a direction about south-south-east; two-thirds of this work has been done.

By act of Congress passed August 2, 1882, $9,000 was appropriated for this work. Proposals were opened September 26, 1882, and a contract dated October 21, 1882, was entered into with J. H. Fenner, of Jersey City, N. J., to dredge in this shoal to a depth of 16 feet, at the rate of $5.50 per ton for removal of bowlders of 1 ton weight and upwards, and 49 cents per cubic yard for sand and smaller stones. The contractor began work November 3, 1882, and completed the contract February 28, 1883; 636.52 tons of bowlders and 9,794 cubic yards of sand and stones were removed and deposited on the dumping-ground southeast of Black Ledge. Many of the larger bowlders had to be blasted; these were left until nearly the end of the work, and a diver and steam drill were employed in their removal.

An area 700 feet long and averaging 90 feet wide was dredged to a depth of 16 feet at mean low water; nearly one-half this area had been dredged to 14 feet depth.

The first work done on this shoal made a depth of 16 feet; the next work, as stated in the Annual Report for 1882, was carried to a depth of 14 feet. According to the representation of those most using the channel, this latter depth was not great enough, their loaded vessels frequently touching bottom at low water, and during the past fiscal year the dredging was carried to the originally projected depth of 16 feet.

As stated in the last annual report $8,200 will be required to complete this work according to the present scheme.

Appropriations for the improvement of New London Harbor have been made and expended as follows, viz:

Date.	Amount.	Application.
June 14, 1880	$2,500	Dredging shoal east of railroad wharf.
March 3, 1881	4,300	Do.
August 2, 1882	9,000	Do.
Total	15,800	

New London, the port of entry for the collection district of New London, is situated about 2½ miles from Long Island Sound; the harbor is the mouth of the Thames River. New London light-house is located at the entrance to the harbor on the west shore. Forts Trumbull and Griswold command the harbor from either side.

Money statement.

July 1, 1882, amount available	$158 89
Amount appropriated by act passed August 2, 1882	9,000 00
	9,158 89
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	9,075 01
July 1, 1883, amount available	83 88
Amount (estimated) required for completion of existing project	8,200 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	8,200 00

Abstract of proposals opened September 26, 1882, for dredging New London Harbor, Connecticut.

No.	Names and addresses.	Price for bowlders.	Price for gravel.	Date of commencement.	Date of completion.
		Per ton.	*Per cu. yd.*		
1	J. H. Fenner, Jersey City, N. J	$5 50	$0 49	No date	June 30, 1883
2	Frank Pidgeon, jr, New York, N. Y	3 25	0 59	do.	June 30, 1883
3	Hartford Dredging Company, Hartford, Conn.	12 00	0 69	do.	June 30, 1883
4	James Caler & Son, Baltimore, Md	6 50	0 47	do.	June 30, 1883
5	John McDermott, Cohoes, N. Y	10 00	0 65	do.	June 30, 1883

Contract awarded to J. H. Fenner; dated October 21, 1882; completed February 28, 1883.

COMMERCIAL STATISTICS.

The following statement of the commerce of the port of New London, Conn., for the fiscal year ending June 30, 1883, is, by the courtesy of the collector of customs, furnished from the records of the custom-house:

Amount of customs collected *	$25,133 22
Number of vessels entered from foreign ports	15
Their tonnage	2,646
Number of vessels cleared to foreign ports	6
Their tonnage	683
Value of imports	$124,364 86
Value of exports	3,494 00

Chief articles of commerce: Free imports, guano and logwood; dutiable imports, sugar and molasses; exports, cooperage.

D 3.

IMPROVEMENT OF CONNECTICUT RIVER, MASSACHUSETTS AND CONNECTICUT.

ABOVE HARTFORD, CONNECTICUT, AND BELOW HOLYOKE, MASSACHUSETTS.

According to the project for improving this section of the Connecticut River, the first permanent work undertaken ought to be the construction of a canal around Enfield Rapids ($10\frac{3}{4}$ miles above Hartford), and the most feasible way of securing 8 feet depth between the head of Enfield Falls and deep water below is by constructing a canal from the head of the falls to the mouth of the Hockanum River, opposite Hartford. The estimated cost of this submitted in the Annual Report for 1881 is $1,322,805.

The amount available during the past fiscal year was not sufficent to make a fair beginning on this work. It is considered that not less than $450,000 should be given to start with.

No dredging appeared to be immediately necessary, and no work was done during the past year. The available funds will be sufficient for any dredging needed during the ensuing year.

I have been unable as yet to obtain any statement of the commerce

* Collections of all kinds included, viz: Duties, marine-hospital tax, tonnage tax, steamboat inspection fees, &c.

of the Connecticut River above Hartford during the fiscal year ending June 30, 1883.

Money statement.

Connecticut River between Hartford, Conn., and Holyoke, Mass.

July 1, 1882, amount available	$13,669 80
July 1, 1883, amount available	13,669 80
Amount (estimated) required for completion of existing project	1,322,805 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	450,000 00

Connecticut River above Hartford and below Enfield Falls.

July 1, 1882, amount available	$1,912 66
July 1, 1883, amount available	1,912 66

Connecticut River on or above Enfield Falls, and below Holyoke, Mass.

July 1, 1882, amount available	$10,702 92
July 1, 1883, amount available	10,702 92

BELOW HARTFORD, CONNECTICUT.

The project under which this improvement is being carried on was adopted in 1880. It is described at length, in a report dated November 11, 1879, by the late Lieut. Col. G. K. Warren, Corps of Engineers, which is printed in the Annual Report of the Chief of Engineers for 1880 (Part I, pages 398 to 422). The project contemplated the protection of the caving banks, chiefly on the outside of bends of the river between Hartford and Rocky Hill (a section of about 9½ miles), by a system of mattresses reaching from below the limit of erosion to a short distance above summer water-level, an average distance of about 50 feet; the rectification of the bank by cutting away projecting parts at Clay Banks, 1½ miles below Hartford, and at Glastonbury Bar, 8 miles below Hartford; the construction of wing-dams at Hartford Bar, at Pratt's Ferry Bar, 4 miles from Hartford, at Press Barn Bar, 5½ miles from Hartford, at Glastonbury Bar, and at Dividend Bar, 10½ miles from Hartford, at an estimated cost of $330,000; also such dredging for the temporary improvement of the channel and such additions to the jetties on Saybrook Bar (at the mouth of the river, 49½ miles below Hartford), as shall from time to time appear necessary, and the cost of which cannot be estimated.

At the beginning of the last fiscal year, July 1, 1882, the only work done towards permanent improvement was the construction of the Glastonbury wing-dam, which was completed during the previous year. Dredging was in progress under contract of John McDermott, of Cohoes, N. Y., dated June 10, 1882, he having removed 9,017.3 cubic yards of sand from Glastonbury Bar, making a depth of 10 feet at low water. This year, in continuation of this contract, 12,177.2 cubic yards additional were removed from Glastonbury Bar, being a total of 21,194.5 cubic yards from that bar, which made a 10-foot channel 1880 feet long and 60 feet wide, the dredging being in three places on the bar; also, 3,103.9 cubic yards were dredged from the Clay Banks, making a 10-foot channel 320 feet long and 60 feet wide, and 16,152.2 cubic yards from Hartford Bar, making a 10-foot channel about 1,600 feet long and 60 feet wide. The contract was completed August 8, 1882, 40,450.6 cubic yards having been dredged.

Under the appropriation of $45,000, made by act of Congress passed August 2, 1882, it was specified that $5,000 should be expended for dredging in Salmon River, a small cove about 32 miles below Hartford. Proposals were called for and opened October 30, 1882, and a contract, dated November 20, 1882, was entered into with H. N. & A. J. Beardsley, of Bridgeport, Conn., to dredge to a depth of 7 feet at mean low water, at the rate of 13 cents per cubic yard. The contractors have been delayed by other Government work, and have not yet begun. An extension of time has been granted them until September 30, 1883, during which the work will be completed.

Proposals for constructing a riprap dike or wing-dam on the west side of Hartford Bar were opened October 30, 1882, and a contract, dated November 20, 1882, was entered into with Ezra H. Williams, of Hartford, Conn., to furnish and deliver the stone at the rate of $1.10 per ton. The contractor began work November 13, 1882. He was obliged to suspend operations during the winter, and resumed in April. At the close of the fiscal year 10,307.29 tons of stone had been delivered and 2,308 linear feet of the wall had been built. The length of the completed work will be about 3,600 feet. It will be finished under the extension of the contract to October 1, 1883.

Proposals for dredging in the Connecticut River below Hartford were opened May 1, 1883, and a contract, dated May 12, 1883, was entered into with the Hartford Dredging Company, of Hartford, Conn., to do the required work at the rate of $11\frac{3}{8}$ cents per cubic yard, the time of completion being August 31, 1883. Work was begun June 4, and at the close of the year 15,836 cubic yards of material had been removed from Hartford Bar, making the channel 50 feet wide for a length of 1,600 feet, and 25 feet wide for an additional length of 870 feet, the depth made being $9\frac{1}{2}$ feet at low water. This dredging is partly in the same place as the work of July and August, 1882. Part of that work is now covered by the dike.

It is of the greatest importance that the protection of the east bank of the Glastonbury Bar should be undertaken at once. This would naturally have immediately followed if it did not precede the construction of a wing-dam at that point, but the appropriation available during the past year was not sufficient to make a fair beginning. The wing-dam built in 1881, has increased the scour and given a somewhat greater depth to the channel. This increased scour has begun to undermine the east bank, and any delay will probably increase the cost of the protection at this point considerably. It is also desired to remove an old wharf and the remains of an old stone pier at the Clay Banks, the estimated cost of which is $3,600. About $10,000 could be expended to advantage in repairing and lengthening the jetties at Saybrook Bar, and in dredging. The urgent necessity of immediate work on the protection of Glastonbury Bank cannot be too strongly presented. For this, and for the other purposes mentioned above, I recommend that an appropriation of $100,000 be asked for.

It is considered that the money now available for Salmon River will do all the work needed for the present at that place.

The Connecticut River is in the collection district of Middletown. By the course of the river the distance from Holyoke, Mass., to Hartford, Conn., is about 34 miles; from Hartford to Long Island Sound about 50 miles. There is a light-house on Saybrook Point, on the west shore of the river at its mouth. The nearest work of defense is Fort Trumbull, New London Harbor, Connecticut, about 16 miles east from Saybrook Point.

Money statement.

July 1, 1882, amount available		$8,363 00
Amount appropriated by act passed August 2, 1882		45,000 00
		53,363 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$14,619 56	
July 1, 1883, outstanding liabilities	6,228 97	
		20,848 53
July 1, 1883, amount available		32,514 47
Amount (estimated) required for completion of existing project		228,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		100,000 00

Abstracts of proposals opened October 30, 1882, for improving Connecticut River below Hartford, Conn.

DREDGING IN SALMON RIVER.

No.	Names and addresses.	Price.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	Hartford Dredging Company, Hartford, Conn	$0 14⅞	No date	June 30, 1883
2	John McDermott, Cohoes, N. Y	15⅞	....do	June 30, 1883
3	J. H. Fenner, Jersey City, N. J	34	....do	June 30, 1883
4	H. N. & A. J. Beardsley, Bridgeport, Conn	13	....do	June 30, 1883

DIKE ON HARTFORD BAR.

Name and address.	Price.	Date of commencement.	Date of completion.
	Per ton.		
Ezra H. Williams, Hartford, Conn	$1 10	Nov. 1, 1882	June 30, 1883

Abstract of proposals opened May 1, 1883, for dredging Connecticut River below Hartford, Conn.

No.	Names and addresses.	Price.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	The Hartford Dredging Company, Hartford, Conn	$0 11⅜	No date	Aug. 31, 1883
2	John McDermott, Cohoes, N. Y	12½	....do	Aug. 31, 1883
3	J. D. Flannery & Bro., Jersey City, N. J	13	....do	Aug. 31, 1883
4	S. A. Hammond, Bridgeport, Conn	13¾	....do	Aug. 31, 1883
5	J. H. Fenner, Jersey City, N. J	15	....do	Aug. 31, 1883

Abstract of contracts for improving Connecticut River below Hartford, Conn., in force during the fiscal year ending June 30, 1883.

No.	Names and addresses.	Date.	Subject.	Price.	Remarks.
1	John McDermott, Cohoes, N. Y.	June 10, 1882	Dredging between Hartford and Middletown.	$0.14⅞ per cubic yard.	Contract completed August 8, 1882.
2	H. N. & A. J. Beardsley, Bridgeport, Conn.	Nov. 20, 1882	Dredging in Salmon River.	$0.13 per cubic yard.	Contract extended to September 30, 1883.
3	Ezra H. Williams, Hartford, Conn.	Nov. 20, 1882	Dike on Hartford Bar.	$1.10 per ton ..	Contract extended to October 1, 1883.
4	Hartford Dredging Company, Hartford, Conn.	May 12, 1883	Dredging below Hartford.	$0.11⅜ per cubic yard.	Contract expires August 31, 1883.

Connecticut River, Conn.

from Hartford to Rocky Hill

June 30, 1883.

Scale of Feet.

1000 500 0 1000 2000 3000 4000 5000

Contours are as follows:

Low water line 0
3-foot curve 3
6- " " 6
9- " " 9
12- " " 12
15- " " 15

Contours show the condition of the channel in 1879.

The heavy black line shows the part of the Hartford Wing Dam built during the past fiscal year.

The enclosed areas show the dredging (1st depth) on Glastonbury Bar and at Clay Banks, in July, 1882, and on Hartford Bar, in June, 1883; the dredging on Hartford Bar in July, 1882, is not shown; it is nearly covered by the later work.

Hartford

4 3/4 miles from Long Island Sound

Hartford Bar and Wing Dam

Colts Ferry

Goodwin's Island

Goodwin's Island Bar

Clay Banks
1 1/2 miles from Hartford

Wethersfield Cove

Keene's Cove

Keene's Bar

Jessies Hollow

Ferry Bar
4 miles from Hartford

Cross Rock Bar
5 1/2 miles from Hartford

Glastonbury Bar
8 miles from Hartford

Glastonbury Wing Dam

Rocky Hill

Steam Ferry

South Glastonbury

Dividend Bar
10 1/2 miles from Hartford

Walter Wood Harland
Asst in charge of Engineers

Clinton Harbor, Conn.

June 30, 1883.

Scale of Feet.

500 0 500 1000 1500 2000

Mean rise of tide 3.88 ft.

Contours are as follows:

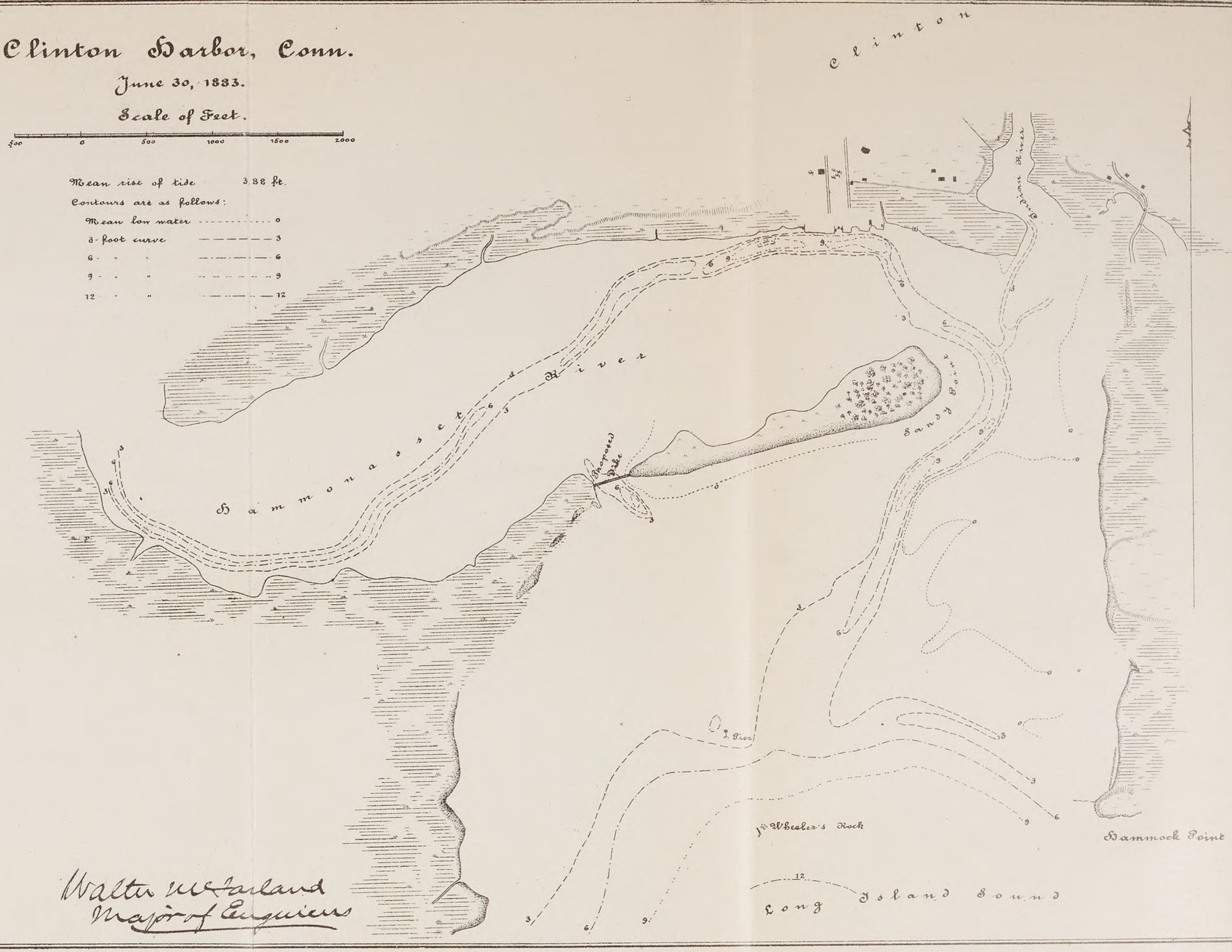
Mean low water 0

3-foot curve ——— 3

6 " " ——·——·—— 6

9 " " ·· ·· ·· ·· 9

12 " " ——··——··—— 12



Walter McFarland
Major of Engineers

COMMERCIAL STATISTICS.

The following statement of the commerce of the port of Middletown, Conn., for the fiscal year ending June 30, 1883, is by the courtesy of the collector of customs furnished from the records of the custom-house.

Amount of customs collected	$36,750 44
Number of vessels entered (domestic)	339
Their tonnage	402,755
Value of imports entered warehouse from other ports	$54,344 07

Chief articles of commerce (foreign): Aniline dyes, wool, steel, spirits and wines, tobacco, clothing.

Tonnage owned in the collection district:

		Tons.
Sailing vessels	72	7,002.66
Steam vessels	22	4,608.76
Unrigged vessels	20	4,097.85
Total	114	15,709.27

The above refers only to vessels entering at the custom-house; the greater number arrive without entry. It is estimated that the total number of vessels arriving during the year is 2,500, carrying 150,000 tons of coal, 12,000,000 feet of lumber, and about 140,000 tons of other merchandise.

D 4.

IMPROVEMENT OF CLINTON HARBOR, CONNECTICUT.

The project for this improvement, first recommended by Major Barlow, in his report on the survey of Clinton Harbor, dated January 17, 1882, and published in Appendix C to the Annual Report of the Chief of Engineers for that year, consists in the construction of a dike across a breach in the beach, and contemplates the excavation of a channel 100 feet wide and 6 feet deep at mean low water, should the dike not prove effectual in opening the channel. The breach was formed about forty years ago, and, by diverting part of the current from the main channel, caused a reduction of the available low-water depth from about 8 to 4 feet.

The appropriation of $3,000, made by act of Congress passed August 2, 1882, will be devoted to the construction of a riprap dike across the breach. Proposals for doing the work were opened April 24, 1883, and the contract was awarded to D. V. Howell, of New York, N. Y. Owing to difficulties which the contractor has met with in securing satisfactory bondsmen, the contract has not yet been made.

It is believed that the available appropriation will be sufficient to construct the dike. Dredging can be postponed advantageously until the effect of the dike in opening the channel has been tested. No appropriation is asked for the year ending June 30, 1885.

Appropriations for the improvement of Clinton Harbor have been made and expended as follows, viz:

Date.	Amount.	Application.
March 3, 1881	*$500	Survey.
August 2, 1882	3,000	Not yet expended.
Total	3,500	

*Allotment from general appropriation for surveys.

Clinton Harbor, Connecticut, is in the collection district of Middletown, on the north shore of Long Island Sound, 9 miles west of the mouth of the Connecticut River. The nearest light-house is on Falkner's Island, 8 miles southwest. Fort Trumblull, New London Harbor, Connecticut, is 23 miles east, and is the nearest work of defense.

The harbor is of local importance only, the commerce being mainly confined to coal and wood, building materials, fertilizers, farm produce, and oysters.

I have as yet been unable to obtain any statement of the amount of commerce at Clinton during the fiscal year ending June 30, 1883.

Money statement.

Amount appropriated by act passed August 2, 1882	$3,000 00
July 1, 1883, amount available	3,000 00

Abstract of proposals opened April 24, 1883, for construction of dike in Clinton Harbor, Connecticut.

No.	Names and addresses.	Price for riprap.	Date of commencement.	Date of completion.
		Per ton.		
1	David V. Howell, New York, N. Y	$1.41	No date	Aug. 31, 1883
2	John Beattie, Leetes's Island, Conn	1.95	do	Aug. 31, 1883
3	Luce & Hoskins, Niantic, Conn	1.70	do	Aug. 31, 1883
4	Frederick K. Ballou, Mystic Bridge, Conn	1.77	do	Aug. 31, 1883

D 5.

IMPROVEMENT OF NEW HAVEN HARBOR, CONNECTICUT.

The work in this harbor consists in making a channel 16 feet deep at mean low water, where the available depth before any Government improvement was made was but 9 feet. The desired depth has been attained above Fort Hale in a channel from 400 to 600 feet wide. The softness of the material of the bar below Fort Hale has prevented any permanence of the work done there. To produce the same depth over this bar, a dike was projected on the west side of the channel; this is now in process of construction under the appropriation of $30,000 made by act of Congress passed August 2, 1882.

The dike is to extend about 3,200 feet parallel to the channel, and the northern end is to be joined to the shore at Sandy Point by a V-shaped arm, about 2,160 feet long, with its apex to the north; for 1,300 feet from the high-water mark this arm is to be of riprap stone; all the rest of the dike will be of a double row of creosoted piles, filled between with stone.

Proposals were opened January 23, 1883, and contracts dated March 22, 1883, were entered into with A. M. Newton, of New York, N. Y., for constructing the pile section at the rate of $21.83 per linear foot of dike, and with David V. Howell, of New York, N. Y., for constructing the riprap section, at the rate of $1.37 per ton of stone. Mr. Howell began work May 11, and has delivered 1,575 tons of granite, building 600 linear feet of dike. An extension of contract to September 15 has been granted, under which the riprap section will be completed. Mr. Newton began driving piles June 9, and has completed 100 linear feet of the pile dike, and partially built 350 feet additional. His contract expires November 30.

The plan for this dike was presented in a letter from Major Barlow to the Chief of Engineers, dated September 9, 1882, which was referred to the Board of Engineers for Fortifications and for River and Harbor Improvements, &c. This plan, with some modifications, was approved by the Board in their report of October 2, 1882. The report was subsequently approved by the Chief of Engineers.

In May, 1883, when work on the dike was just beginning, vigorous protests were made by oyster-growers against the location of the shore connection, as running over some of the most valuable oyster grounds in the harbor. These protests were presented to the Chief of Engineers, and referred to the Board of Engineers for consideration. Upon their recommendation a line for the shore connection was approved which makes it nearly straight, and does very little injury to the oyster grounds.

Under the contracts now in force the stone connection of the dike, which includes all of the riprap work and about 850 feet of the pile work, will be completed, as also about 250 feet of the channel dike. There remains, therefore, 2,950 feet of the channel dike to be built, which, at the rate of the present work, will cost, including superintendence and contingencies, about $70,000. This is greater than the originally estimated cost of the whole dike, partly on account of the length of the pile work being greater than was then contemplated, but chiefly on account of the greater cost of this class of work. There is no competition in the creosoting process, and consequently no market rates for that part of the work.

The dike could be readily completed in one year, and it is very desirable that this be done, on the ground of economy and safety.

I have recently received a memorial signed by a number of prominent citizens of New Haven, urging the necessity of finishing the dike at once, and the importance of further dredging in the harbor. A copy of this paper is attached to the report upon the New Haven Breakwater. One hundred thousand dollars could be profitably expended upon these works during the year ending June 30, 1885.

Appropriations for the improvement of New Haven Harbor have been made and expended as follows, viz:

Date.	Amount.	Application.
August 30, 1852	$6,000	Removal of Middle Rock, not expended until 1867.
July 11, 1870	15,000	Removal of rocks.
March 3, 1871	40,000	Dredging (13 feet) above Fort Hale.
June 10, 1872	35,000	Dredging (16 feet) below Fort Hale. Removal of rocks.
March 3, 1873	25,000	Dredging (16 feet) below Fort Hale.
March 3, 1875	10,000	Dredging (13 feet) above Long Wharf.
June 18, 1878	25,000	Dredging (16 feet), Long Wharf to Fort Hale.
March 3, 1879	15,000	Dredging (16 feet) above Long Wharf.
June 14, 1880	15,000	Dredging (16 feet) above Fort Hale.
March 3, 1881	15,000	Dredging (16 feet), Long Wharf to Fort Hale.
August 2, 1882	30,000	Dike opposite Fort Hale.
Total	231,000	

New Haven, the port of entry for the collection district of New Haven, is situated at the head of New Haven Harbor, about 3½ miles from Long Island Sound. There is a light-house on Southwest Ledge, at the mouth of the harbor. Fort Hale, 2 miles below the city, commands the channel.

Money statement.

July 1, 1882, amount available		$3,464 96
Amount appropriated by act passed August 2, 1882		30,000 00
		33,464 96
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$2,265 45	
July 1, 1883, outstanding liabilities	2,157 75	
		4,423 20
July 1, 1883, amount available		29,041 76
Amount that can be profitably expended in fiscal year ending June 30, 1885		100,000 00

Abstract of proposals opened January 23, 1883, for constructing dike in New Haven Harbor, Connecticut.

No.	Names and addresses.	Price for riprap.	Price for pile and stone.	Date of commencement.	Date of completion.
		Per ton.	*Pr. lin. ft.*		
1	Stephen A. Kelly, Brooklyn, N. Y	$1 49	$27 24	To date	Nov. 30, 1883
2	Henry Du Bois & Sons, New York, N. Y	.....	23 48	do	Nov. 30, 1883
3	John A. Bouker, New York, N. Y	1 88	.....	do	Nov. 30, 1883
*4	S. A. White, Westfield, Mass	1 45	19 93	do	Nov. 30, 1883
5	Frank Pidgeon, jr., New York, N. Y	.....	26 39	do	Nov. 30, 1883
6	A. M. Newton, New York, N. Y	.....	21 83	do	Nov. 30, 1883
7	Charles H. Edwards, Boston, Mass	1 69	.....	do	Nov. 30, 1883
†8	David V. Howell, New York, N. Y	1 37	9 27	do	Nov. 30, 1883

* Bidder stipulates that the cost of creosoting is to be added to the price of the pile work.
† Refused to enter into contract for pile work at price named.

Abstract of contracts for improvement of New Haven Harbor, Connecticut, in force during fiscal year ending June 30, 1883.

Names and addresses.	Date.	Subject.	Price.	Price.	Remarks.
			Per ton.	*Pr. lin. ft.*	
David V. Howell, New York, N. Y.	Mar. 22, 1882	Riprap dike ..	$1 37	.....	Expired June 30, 1883; extended to September 15, 1883.
A. M. Newton, New York, N. Y.	Mar. 22, 1882	Pile and stone dike.	.....	$21 83	Expires November 30, 1883.

COMMERCIAL STATISTICS.

The following statement of the commerce of the port of New Haven, Conn., for the fiscal year ending June 30, 1883, is, by the courtesy of the collector of customs, furnished from the records of the custom-house:

Amount of customs collected	$381,450 22
Number of vessels entered from foreign ports	84
Their tonnage	18,126
Number of vessels cleared for foreign ports	42
Their tonnage	7,228
Value of merchandise imported	$1,155,883 28
Value of merchandise exported	$671,046 00
Number of vessels entered coastwise	6,325

RECEIPTS OF MERCHANDISE COASTWISE.

	Tons.	Value.
Coal	750,000	$3,750,000 00
Iron	55,000	2,000,000 00
Lumber		3,000,000 00
Miscellaneous		85,213,900 00
Total		93,963,900 00
Shipments coastwise		74,812,000 00
Total value receipts and shipments, foreign and domestic		170,602,829 28

D 6.

CONSTRUCTION OF BREAKWATER AT NEW HAVEN, CONNECTICUT.

The project under which this work was begun was adopted in accordance with a plan of the Board of Engineers for Fortifications and for River and Harbor Improvement, submitted November 24, 1879. It con-

templated, first, the construction of an east breakwater from Southwest Ledge to Quixes Ledge, a distance of 3,300 feet, to be followed by a west breakwater in the vicinity of Luddington Rock, extending northwesterly and southeasterly for a length of 4,200 feet. The construction of the east breakwater was begun at the southwest ledge end, and up to the present time 126,989 tons of stone have been delivered in it, making its length 1,378 feet.

An act of Congress passed August 2, 1882, appropriated $60,000 for this work; proposals were opened September 27, 1882, and contracts were made under dates, respectively, of October 18 and October 20, 1882, with Frederick K. Ballou, of Boston, Mass., for 10,000 tons of riprap granite at $1.14½ per ton, and with John A. Bouker, of Jersey City, N. J., for about 38,000 tons at $1.15 per ton.

Mr. Bouker began work November 21, 1882, and has delivered 11,973 tons of stone, building 140 linear feet of work. Mr. Ballou began May 3, 1883, and has delivered 1,124 tons of stone, building 13 linear feet of work. During the year 13,097 tons of stone have been delivered, and 153 linear feet of the breakwater have been built. Mr. Ballou's work was begun about 300 feet east of the main part of the breakwater, for convenience in discharging; the gap between the sections will be closed under the present contracts. Both the contracts expire October 31, 1883. Upon their completion the length of the breakwater will be about 1,770 feet.

The importance of this work has been so frequently stated in previous reports that it seems unnecessary to enlarge upon it here. The Board of Engineers, in recommending this plan for a harbor of refuge, expressed the opinion that—

> After the completion of a certain portion of the easterly breakwater, the westerly one should be promptly commenced.

Though it would not be desirable to suspend work on the east breakwater until the shelter afforded by it is of greater extent, yet the west one could be begun now to advantage and continued in connection with the other, provided an appropriation large enough for both were made; $500,000 could be expended profitably upon these works during the year ending June 30, 1885.

I send herewith a copy of a memorial signed by a number of prominent citizens of New Haven, calling attention to the importance of the rapid prosecution of this and other harbor work at New Haven, and urging the necessity of liberal appropriations for it.

The total cost of both breakwaters, as estimated by the Board of Engineers, is $1,311,134. Appropriations have been made as follows, viz:

Date.	Amount.	Application.
March 3, 1879	$30,000	Building 348 feet of breakwater.
June 14, 1880	30,000	Building 342 feet of breakwater.
March 3, 1881	60,000	Building 535 feet of breakwater.
August 2, 1882	60,000	Building 545 (estimated) feet of breakwater.
Total	180,000	

New Haven, the port of entry for the collection district of New Haven, is situated at the head of New Haven Harbor, about 4 miles north of the breakwater. There is a light-house on Southwest Ledge, the west terminus of the east breakwater, and Fort Hale, 2 miles north from the breakwater, commands New Haven Harbor.

Money statement.

July 1, 1882, amount available		$76 19
Amount appropriated by act passed August 2, 1882		5,000 00
		5,076 19
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$13,314 88	
July 1, 1883, outstanding liabilities	5,350 16	
		18,665 04
July 1, 1883, amount available		42,057 30
Amount (estimated) required for completion of existing project		1,131,134 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		500,000 00

Abstract of proposals opened September 27, 1882, for construction of breakwater at New Haven, Conn.

No.	Names and addresses.	Price per ton.	Date of commencement.	Date of completion.
1	C. T. Derry & Co., Boston, Mass	$1 70	No date	Oct. 31, 1883
2	John Fleming, New York, N. Y	1 20	....do	Oct. 31, 1883
3	Charles A. Brown, New York, N. Y	1 25	....do	Oct. 31, 1883
4	Arnold & Stephens, Haverstraw, N. Y	1 19½	....do	Oct. 31, 1883
5	Frederick K. Ballou, Boston, Mass	1 14½ for 10,000 tons; 1 19½ for 10,000 tons; 1 23 for balance.	....do	Oct. 31, 1883
6	John A. Bouker, Jersey City, N. J	1 15	....do	Oct. 31, 1883
*7	Thomas A. Scott, New London, Conn	1 10	....do	Oct. 31, 1883

*Informal; presented after the others had been opened and read.

Abstract of contracts for construction of breakwater at New Haven, Conn., in force during the fiscal year ending June 30, 1883.

Names and addresses.	Date.	Subject.	Price per ton.	Remarks.
Frederick K. Ballou, Boston, Mass	Oct. 18, 1882	Delivery of stone.	$1 14½	Expires Oct. 31, 1883
John A. Bouker, Jersey City, N. J	Oct. 20, 1882	....do	1 15	Expires Oct. 31, 1883

MEMORIAL FROM THE MAYOR, MEMBERS OF THE CHAMBER OF COMMERCE, AND OTHER PROMINENT CITIZENS OF NEW HAVEN, CONNECTICUT.

MAYOR'S OFFICE, No. 7, CITY HALL,
New Haven, Conn., July 4, 1883.

MY DEAR SIR: I beg leave to call your attention to the necessities of our harbor, and to urge upon you the earnest desire of our people, especially those engaged in our commercial and manufacturing industries, to the great need of a larger appropriation than heretofore made for the continuation of our breakwater, the building of dikes and jetties, and the dredging of the channels, &c.

We feel that our harbor, rating as it does among the foremost of the country, and in the further consideration of its being an important harbor of refuge for the ever-increasing commerce passing through Long Island Sound, as well as for many other reasons not necessary to mention here, demands immediately an appropriation much larger than we dare ask for.

We trust, however, and I am urged on all sides, to request of you to ask for an appropriation of at least $500,000 for the continuation of the breakwater, $50,000 for the dikes and jetties, and a further sum of $50,000 for dredging and improving the channels.

It is unnecessary for me to state to you that these subjects received the careful study and consideration of your predecessor, Colonel Barlow, and met with his hearty co-operation, and were fully indorsed by Generals Tower, Newton, and Abbott, as the facts have undoubtedly been called to your attention before this.

Hoping the subject-matter may meet your cordial approval, and that we may rely upon your good offices in our behalf, allow me to subscribe myself with very great respect.

Yours, &c.,

HENRY G. LEWIS,
Mayor of the city of New Haven and
President of its Chamber of Commerce,
And sixteen others.

Col. WALTER MCFARLAND,
U. S. Engineer Corps.

D 7.

IMPROVEMENT OF MILFORD HARBOR, CONNECTICUT.

The original plan for the improvement of this harbor, adopted in 1872, was reported completed a year ago, and under the appropriation of $5,000 made by act of Congress passed August 2, 1882, a project was submitted and approved for deepening the entrance channel to 8 feet at mean low water for a width of 100 feet. Twenty-five feet of this width had already been dredged as an experiment and was found to be fairly permanent.

After duly receiving proposals, a contract was made with Henry James Lewis, of Meriden, Conn., to do the required work at the rate of 14½ cents per cubic yard. The contractor is an oyster-planter, and his object in bidding was to secure the deposit of the dredged material in his oyster beds. As this disposition of the material could in no way injure navigation interests, his plan was assented to.

Dredging was begun June 12, 1883, and at the close of the year 10,819 cubic yards of sand and gravel had been removed, making a cut 40 feet wide, 8 feet deep, and 1,050 feet long on the east side of the experimental channel previously dredged and extending from deep water in the outer harbor nearly to the long jetty. Work will be continued under an extension of the contract to August 1, 1883; it is estimated that the present contract will leave the entrance channel of a width of 65 feet over its entire length, and somewhat greater width at the bend.

To complete the work to the projected width of 100 feet will require $6,000 additional.

Appropriations for the improvement of Milford Harbor have been made and expended as follows, viz:

Date.	Amount.	Application.
June 10, 1872	*$1,500	Survey.
June 23, 1874	5,000	Jetties on east shore.
March 3, 1875	13,000	Long jetty and dredging mouth of river.
June 18, 1878	10,000	Dredging to Town Wharf.
June 14, 1880	5,000	Dredging above Town Wharf and below Merwin's Wharf.
March 3, 1881	*100	Survey for breakwater.
August 2, 1882	5,000	Dredging (8 feet) below Merwin's Wharf.
Total	39,600	

* Allotments from general appropriations for surveys.

Milford Harbor, Connecticut, is in the collection district of New Haven, on Long Island Sound, about 9 miles west of Fort Hale, New Haven Harbor. The nearest light-house is on Stratford Point, 4 miles to the westward. With the exception of the oyster business, which is conducted on rather a large scale, and one fish-oil works, the harbor is of only local importance.

Money statement.

July 1, 1882, amount available		$76 19
Amount appropriated by act passed August 2, 1882		5,000 00
		5,076 19
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$18 13	
July 1, 1883, outstanding liabilities	1,664 95	
		1,683 08
July 1, 1883, amount available		3,393 11
Amount (estimated) required for completion of existing project		6,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		6,000 00

Abstract of proposals opened September 26, 1882, for dredging harbor at Milford, Conn.

No.	Names and addresses.	Price.	Date of commencement.	Date of completion.
		Per cu yd.		
1	Hartford Dredging Company, Hartford, Conn	$0 17⅞	No date	June 30, 1883
2	A. N. & A. J. Beardsley, Bridgeport, Conn	18	....do	June 30, 1883
3	Henry James Lewis, Meriden, Conn	14½	April 1, 1883	June 30, 1883
4	J. H. Fenner, Jersey City, N. J	17	No date	June 30, 1883
5	James Caler & Son, Baltimore, Md	23	....do	June 30, 1883
6	Frank Pidgeon, jr., New York, N. Y	19	....do	June 30, 1883
7	John McDermott, Cohoes, N. Y	19	....do	June 30, 1883

Contract, dated October 19, 1882, awarded to Henry James Lewis; extended to August 1, 1883.

COMMERCIAL STATISTICS.

The following statement relating to the commerce of Milford Harbor during the fiscal year ending June 30, 1883, is obtained through the courtesy of the collector of customs for the district of New Haven:

Chief articles of commerce, oysters and menhaden, amounting to over $500,000 per year.

Two wharves are to be built this fall to accommodate the increasing oyster business.

D 8.

IMPROVEMENT OF HOUSATONIC RIVER, CONNECTICUT.

The project for this improvement consists in making and keeping open a channel 7 feet deep and 100 feet wide, from Long Island Sound to Derby, Conn., a distance of 13 miles. Since 1874 work has been confined to reopening channels which had filled since the previous dredging. No work has ever been done on the bar at the mouth of the river, where the depth is about 4 feet at mean low water.

An appropriation of $2,000 was made for the Housatonic River by act of Congress passed August 2, 1882. An examination made in June, 1883, showed that the places most requiring dredging were Mill Bar and Drew's Bar. No work has yet been done, owing to unavoidable delays in making the preliminary examination. It may prove expedient to postpone the expenditure of this money until the spring of 1884.

Drew's Rock lies near the west shore of the river, 3½ miles below Derby, and contains about 419 cubic yards of ledge rock above the 7-foot curve. Formerly there was a channel on either side of the rock. A survey was made in 1871, at which time the removal of the rock was contemplated. On the ground of economy this plan was given up, and in 1872 an embankment was built, containing 426 cubic yards of rip-rap

stone, to connect the rock with the west shore. Since that time shoals have formed both above and below the rock during nearly every freshet, and $7,709 have been expended in their removal. The original estimate for the removal of the rock was $6,285. The embankment could be taken out with a clam-shell dredge and thrown up on shore at a probable cost of $600. I recommend that this plan be adopted, and that, to cover contingencies, an appropriation of $10,000 be asked for, for the year ending June 30, 1885, to effect this removal and to do such dredging as may be necessary at shoal places in the river.

Appropriations for the improvement of Housatonic River have been made and expended as follows, viz:

Date.	Amount.	Application.
July 11, 1870	*$2,700	Survey.
March 3, 1871	15,000	Sow and Pigs Jetty, dredging.
June 10, 1872	15,000	Drew's Rock Jetty, dredging.
March 3, 1873	10,000	Dredging.
June 23, 1874	10,000	Do.
March 3, 1875	5,000	Dredging by hired labor.
June 18, 1878	5,000	Dredging.
June 14, 1880	2,000	Do.
March 3, 1881	2,000	Do.
August 2, 1882	2,000	Not yet expended.
Total	68,700	

* Allotment from general appropriation for surveys.

The Housatonic River is the boundary of the collection districts of New Haven and Fairfield; Derby and Birmingham are in the collection district of New Haven, and Shelton is in the collection district of Fairfield. The nearest light-house is on Stratford Point, at the mouth of the river, and the nearest work of defense is Fort Hale, New Haven Harbor, 13 miles east.

Money statement.

July 1, 1882, amount available	$, 115 40
Amount appropriated by act passed August 2, 1882	2,000 00
	2,115 40
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	118 40
July 1, 1883, amount available	1,997 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	10,000 00

COMMERCIAL STATISTICS.

Through the courtesy of the collector of customs at New Haven, the following statement of the commerce of the ports of Birmingham, Derby, and Shelton (at the head of navigation on the Housatonic River), during the past fiscal year has been obtained:

	Birmingham and Derby.	Shelton.
Number of vessels arrived	231	260
Their tonnage	46,000	26,000
Number of vessels departed	231	260
Their tonnage	.....	26,000
Value of merchandise received	$450,000	.....
Value of merchandise shipped	2,000	*$260,000

* Estimated.

Chief articles of commerce: Coal, iron, brick, lumber, paper stock, and machinery.

D 9.

IMPROVEMENT OF BRIDGEPORT HARBOR, CONNECTICUT.

The scheme for making a channel 200 feet wide and 12 feet deep at mean low water from Long Island Sound to the lower bridge was completed at the date of the last annual report, and under the appropriation of $10,000 made by act of Congress passed August 2, 1882, a project was adopted for widening the channel between the inner beacon and the Naugatuck Railroad wharf, the additional width to be used as a harbor of refuge to relieve the crowding of the channel by vessels which frequently take refuge there in stormy weather. The estimated cost of increasing the width of this part of the channel to 600 feet was $60,000.

Proposals were opened September 26, 1882, and a contract, dated October 20, 1882, was entered into with Henry Du Bois & Sons, of New York, N. Y., to do the required dredging at the rate of 9¾ cents per cubic yard. The contractors began work November 21, 1882, and completed their contract February 8, 1883, having removed 90,561 cubic yards of material, principally mud. The width of channel from the inner beacon to the railroad wharf was previously 300 feet; it was increased by from 50 to 100 feet over the entire distance, straightening the west side of the channel, and for 1,600 feet (nearly one-half) of the lower part, an additional width of 60 feet was dredged. The depth of dredging was 12 feet at mean low water.

According to the estimate $50,000 will be required to complete the channel at this place to 600 feet. About one-half of this sum, $25,000, could be profitably expended during the fiscal year ending June 30, 1885.

Appropriations for the improvement of Bridgeport Harbor have been made and expended as follows, viz:

Date.	Amount.	Application.
July 4, 1836	$10,000	Dredging outer bar.
August 30, 1852	10,000	Dredging outer and inner bars.
June 23, 1866	Unknown	Survey.
July 11, 1870	Unknown	Do.
March 3, 1871	20,000	Dredging and 521 feet of jetty.
June 10, 1872	40,000	Dredging and 859 feet of jetty.
March 3, 1873	30,000	Dredging inner bar and upper harbor.
June 23, 1874	20,000	Dredging, bridge to Long Island Sound (9 feet).
March 3, 1875	15,000	Dredging, bridge to Long Island Sound (12 feet).
August 14, 1876	10,000	Dredging upper harbor (9 feet).
June 18, 1878	10,000	Dredging above bridge and outer bar (9 and 12 feet).
March 3, 1879	10,000	Dredging, bridge to Long Island Sound (12 feet).
June 14, 1880	10,000	Dredging, bridge to Long Island Sound (12 feet).
March 3, 1881	10,000	Dredging, above inner beacon (12 feet).
August 2, 1882	10,000	Dredging, between inner beacon and railroad wharf (12 feet).
Total	205,000	

Bridgeport, the port of entry for the collection district of Fairfield, is situated about 2 miles from Long Island Sound, at the head of Bridgeport Harbor. There is a light-house at the entrance to the harbor; and Fort Hale, New Haven Harbor, the nearest work of defense, is 18 miles east.

Money statement.

July 1, 1882, amount available	$360 74
Amount appropriated by act passed August 2, 1882	10,000 00
	10,360 74
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	9,533 51
July, 1, 1883, amount available	827 23
Amount (estimated) required for completion of existing project	50,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	25,000 00

Abstract of proposals opened September 26, 1882, for dredging harbor at Bridgeport, Conn.

No.	Names and addresses.	Price.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	James Caler & Son, Baltimore, Md	$0 17½	No date	June 30, 1883
2	Edgar M. Payn, Albany, N. Y	18 9/10	April 1, 1883	June 30, 1883
3	Henry Du Bois & Sons, New York, N. Y	9¾	No date	June 30, 1883
4	H. N. & A. J. Beardsley, Bridgeport, Conn	10	...do	June 30, 1883
5	Frank Pigeon, jr., New York, N. Y	11	....do	June 30, 1883

Contract, dated October 20, 1882, awarded to Henry Du Bois & Sons; completed February 8, 1883.

COMMERCIAL STATISTICS.

The following statement of the commerce of the port of Bridgeport, Conn., for the fiscal year ending June 30, 1883, is, by the courtesy of the collector of customs, furnished from the records of the custom-house:

Amount of customs collected	$5,916 02
Number of vessels entered from foreign ports	22
Their tonnage	3,364
Number of vessels cleared for foreign ports	17
Their tonnage	3,229
Value of imports	$10,400 04
Value of exports	6,025 56
Chief articles of import, gypsum, salt, coal, lumber, and lath.	
Chief articles of export, pig iron.	
Estimated number of vessels arrived and departed coastwise	13,148
Estimated total tonnage	3,234,690
Estimated value of cargoes received	$38,000,000
Estimated value of cargoes shipped	38,900,000
Estimated number of vessels entering harbor for refuge	936

D 10.

IMPROVEMENT OF SOUTHPORT HARBOR, CONNECTICUT.

The project, adopted in 1876 and modified in 1880, under which the improvement of this harbor has been conducted, contemplated a channel 100 feet wide and 4 feet deep at mean low-water. The channel has been made 95 feet wide from Long Island Sound to the south end of the breakwater, 80 feet wide from there to White Rock, and 50 to 60 feet wide above White Rock, and the improvement of this harbor may be considered completed as far as at present desired.

An act of Congress passed August 2, 1882, appropriated $3,000 for Southport Harbor. Proposals for dredging were opened September 26, 1882, and a contract dated October 21, 1882, was entered into with J. H. Fenner, of Jersey City, N. J., to do the required work at the rate of

32 cents per cubic yard. The contractor began work April 23, and finished the contract May 19, 1883, having removed 8,390 cubic yards of material, principally sand and gravel. One cut and part of a second cut were made from the south end of the breakwater to White Rock, and two forking channels, each 50 feet wide, from the upper end of the main channel towards the principal landings of the village. These branch channels were made at the request of those most interested in the shipping of Southport, who insisted that the interests of the port would be much better accommodated in this way than by widening the main channel to the contemplated width.

As very little filling has taken place during the progress of this work, it is believed that the improvement now completed will be reasonably permanent, and that it will answer the needs of the local commerce for several years to come.

Appropriations for the improvement of Southport Harbor have been made and expended as follows, viz:

Date.	Amount.	Application.
March 2, 1829	$6,097 00	Breakwater, dike, and dredging.
July 3, 1832	4,490 23	Completing breakwater and dike, building beacons, and a small amount of dredging.
July 4, 1836	1,500 00	
March 3, 1837	1,000 00	
July 11, 1870	* Unknown.	Examination and report.
March 3, 1875	5,000 00	Repairs on breakwater.
August 14, 1876	5,000 00	Repairs on dike and dredging.
June 14, 1880	2,500 00	Dredging upper harbor.
March 3, 1881	2,500 00	Dredging on bar.
August 2, 1882	3,000 00	Dredging upper harbor.
Total	31,087 23	

* Allotment from general appropriation for surveys.

Southport Harbor is in the collection district of Fairfield, on the north shore of Long Island Sound, about 6 miles west of Bridgeport. The nearest light-house is on Penfield's Reef, 3½ miles east of the harbor. Fort Halé, New Haven Harbor, 24 miles east, is the nearest work of defense.

Money statement.

July 1, 1882, amount available	$155 85
Amount appropriated by act passed August 2, 1882	3,000 00
	3,155 85
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	2,841 78
July 1, 1883, amount available	314 07

Abstract of proposals opened September 26, 1882, for dredging harbor at Southport, Conn.

No.	Names and addresses.	Price.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	John McDermott, Cohoes, N. Y	$0 34¾	No date	June 30, 1883
2	Frank Pidgeon, jr., New York, N. Y	39	do	June 30, 1883
3	H. N. & A. J. Beardsley, Bridgeport, Conn	50	do	June 30, 1883
4	J. H. Fenner, Jersey City, N. J	34	do	June 30, 1883
*5	James Caler & Son, Baltimore, Md	32	do	June 30, 1883
6	Hartford Dredging Company, Hartford, Conn	35	do	June 30, 1883

* "If we are the successful bidders on Southport will not accept it unless we are the lowest and successful bidders on some of the other jobs."

At the request of J. H. Fenner, the next lowest bidder, the contract was awarded to him at the price bid by James Caler & Son; contract dated October 21, 1882, completed May 19, 1883.

COMMERCIAL STATISTICS.

The following statement of the commerce of Southport, Conn., during the fiscal year ending June 30, 1883, is obtained through the courtesy of the collector of customs for the district of New Haven:

Number of vessels arrived		175
Their tonnage		10,500
Number of vessels departed		175
Their tonnage		10,500
Chief articles of commerce:		
Coal	tons..	5,000
Lumber	feet..	200,000
Farm produce and general merchandise (estimated value)		$190,000

D 11.

IMPROVEMENT OF NORWALK HARBOR, CONNECTICUT.

The project for this improvement, adopted in 1872, contemplated making a channel 100 feet wide and 6 feet deep from deep water at Gregory's Point to the Norwalk wharves, a distance of 2½ miles. The progress already made gives a channel of 6 feet depth and from 60 to 100 feet width above the railroad bridge, and a channel below that bridge of 75 feet width, where the depth has been made 8 feet.

By act of Congress passed August 2, 1882, $5,000 was appropriated for this improvement Proposals were opened September 26, and a contract dated October 21, 1882, was entered into with John McDermott, of Cohoes, N. Y., to do the dredging required, at the rate of 18 cents per cubic yard. The contractor began work October 4, and completed his contract December 9, 1882, having removed 25,003 cubic yards of mud and shells. The work was done between the railroad bridge and Jennings' Wharf, over a distance of 3,500 feet; the width of channel was increased by from 20 to 70 feet, making it 100 feet wide, except for a short distance on a straight course above Squirrel Point, where the width is but 80 feet; at the sharpest part of the bends around Squirrel Point and Oyster Shell Point the width was made 130 feet. The depth made was 6 feet at mean low water.

According to previous estimates the amount required to complete this project so as to make the full width of 100 feet is $15,000.

Appropriations for the improvement of Norwalk Harbor have been made and expended as follows, viz:

Date.	Amount.	Application.
March 3, 1829	$80 00	Survey.
March 3, 1871	*1,166 66	Do.
June 10, 1872	10,000 00	Dredging (6 feet) above South Norwalk.
March 3, 1873	10,000 00	Do.
June 23, 1874	10,000 00	Do.
March 3, 1875	7,000 00	Dredging (6 feet) below South Norwalk.
June 18, 1878	6,000 00	Do.
March 3, 1879	10,000 00	Dredging (6 feet) above and below South Norwalk.
June 14, 1880	5,000 00	Dredging (8 feet) below South Norwalk.
March 3, 1881	5,000 00	Dredging (8 feet) below and (6 feet) above South Norwalk.
August 2, 1882	5,000 00	Dredging (6 feet) above South Norwalk.
Total	69,246 66	

*Allotment from general appropriation for surveys.

Norwalk Harbor is in the collection district of Fairfield, 11 miles west of Bridgeport. Norwalk light-house is on Sheffield's Island at the entrance to the harbor. The nearest works of defense are the fortifications at Throg's Neck, 29 miles distant.

Money statement.

July 1, 1882, amount available	$310 19
August 14, 1882, overpayment refunded	296 30
Amount appropriated by act passed August 2, 1882	5,000 00
	5,606 49
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	5,091 14
July 1, 1883, amount available	515 35
Amount (estimated) required for completion of existing project	15,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	15,000 00

Abstract of proposals opened September 26, 1882, for dredging harbor at Norwalk, Conn.

No.	Names and addresses.	Price.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	Hartford Dredging Company, Hartford Conn	$0 20	No date	June 30, 1883
2	John McDermott, Cohoes, N. Y	18	do	June 30, 1883
3	Frank Pidgeon, jr., New York, N. Y	19. 9	do	June 30, 1883
4	H. N. & A. J. Beardsley, Bridgeport, Conn	18	do	June 30, 1883
5	James Caler & Son, Baltimore, Md	21	do	June 30, 1883
6	J. H. Fenner, Jersey City, N. J	22	do	June 30, 1883

Contract, dated October 21, 1882, awarded to John McDermott; completed December 9, 1882.

COMMERCIAL STATISTICS.

Through the courtesy of the collector of customs at Bridgeport, Conn., the following statement of the commerce of Norwalk Harbor during the past fiscal year has been obtained:

Number of vessels arriving and departing, 2,500.

CHIEF ARTICLES OF COMMERCE.

		Received.	Shipped.
Coal	tons	90,000	.....
Iron	do	4,000	.....
Lumber	feet	1,400,000	500,000
Granite and other stone	tons	.....	5,500
Ice	do	.....	9,000
General merchandise not otherwise included	do	75,000	40,000

D 12,

IMPROVEMENT OF MAMARONECK HARBOR, NEW YORK.

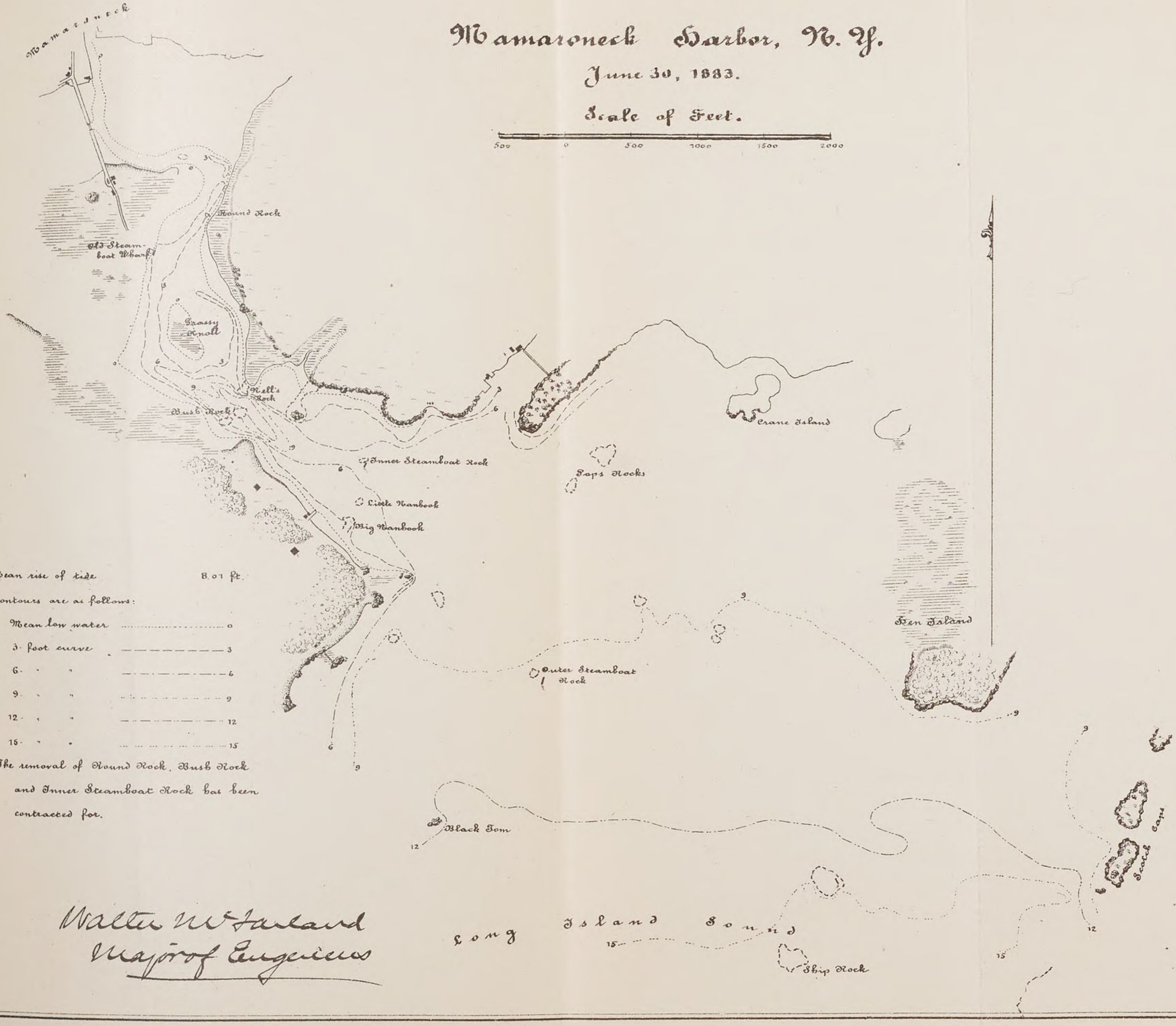
In the report of Major Barlow, Corps of Engineers, upon a survey of Mamaroneck Harbor, made in 1881, the plan of removing six rocks to a depth of 7 feet at mean low water, dredging a channel 7 feet deep and 100 feet wide to the old steamboat wharf, and 4 feet deep and 80 feet wide above this wharf, and building a sand dike to cut off the channel east of Grassy Knoll, was submitted, the total cost of which was estimated at $43,000. Work under this project has not yet been begun.

Mamaroneck Harbor, N. Y.

June 30, 1883.

Scale of Feet.

500 0 500 1000 1500 2000



Mean rise of tide 8.01 ft.

Contours are as follows:

- Mean low water 0
- 3 foot curve ———— 3
- 6 " " —·—·—·— 6
- 9 " " ····· 9
- 12 " " —— —— 12
- 15 " " ····· 15

The removal of Round Rock, Bush Rock and Inner Steamboat Rock has been contracted for.

Walter McFarland
Major of Engineers

An appropriation of $15,000 for this improvement was made by act of Congress passed August 2, 1882. In accordance with the project the first work to be done was the removal of rocks, and proposals for removing Round Rock to a depth of 4 feet and Bush Rock and Inner Steamboat Rock to a depth of 7 feet at mean low water, were opened April 24, 1883. A contract dated June 6, 1883, was entered into with J. H. Fenner, of Jersey City, N. J., to do the required work for the gross sum of $13,000. The contractor or has not yet begun work, but will probably begin during July. The contract expires November 30, 1883. The estimated amount required to complete the project is $28,000. This could be advantageously expended in one year.

Appropriations for the improvement of Mamaroneck Harbor, New York, have been made and expended as follows, viz:

Date.	Amount.	Application.
March 3, 1881	*$500	Survey.
August 2, 1882	15,000	Not yet expended.

*Allotment from general appropriation for surveys.

Mamaroneck Harbor, New York, is in the collection district of New York, on the north shore of Long Island Sound, about 4 miles southwest from the Connecticut State line. Its commerce is chiefly of local importance. The nearest light-house is on Sands Point L. I., 4 miles south; the fortifications at Throg's Neck, 8 miles southwest, are the nearest works of defense.

I have as yet been unable to obtain any statement of the amount of commerce at Mamaroneck during the fiscal year ending June 30, 1883.

Money statement.

Amount appropriated by act passed August 2, 1882	$15,000	00
July 1, 1883, amount expended during fiscal year	78	60
July 1, 1883, amount available	14,921	40
Amount (estimated) required for completion of existing project	28,000	00
Amount that can be profitably expended in fiscal year ending June 30, 1885	28,000	00

Abstract of proposals opened April 24, 1883, for removing rocks from Mamaroneck Harbor, New York.

No.	Names and addresses of bidders.	Lump price for removing Round Rock, Bush Rock, and Inner Steamboat Rock.	Date of commencement.	Date of completion.
1	Hiram W. Phillips, Quincy, Mass	$24,500	No date	Aug. 15, 1884
2	Edward R. Lowe, New York, N. Y	13,237	do	Nov. 30, 1883
3	George W. Townsend, Boston, Mass	16,000	do	Nov. 30, 1883
	George W. Townsend,* Boston, Mass	13,800	.....	.....
4	J. H. Fenner, Jersey City, N. J	13,000	No date	Nov. 30, 1883

* Or will do the work for $13,800, provided payment be made as follows: Upon the completion of every 100 yards to the required depth and acceptance of same, 80 per cent. to be paid, reserving 20 per cent. of each payment until final completion of whole work.

Contract, dated June 6, 1883, awarded to J. H. Fenner; expires November 30, 1883.

D 13.

IMPROVEMENT OF PORT JEFFERSON HARBOR, NEW YORK.

The object of this improvement is to make a channel 100 feet wide and 8 feet deep at mean low water at the entrance to the harbor and to protect the same by jetties so as to make it permanent. In 1877 and 1879, after the jetties were well advanced, the channel of the required depth and width was dredged. The east jetty has now been carried out to a depth of 10 feet at mean low water, making a total length of 1,390 feet, building it to a height of 5 feet above mean high water. The west jetty is 940 feet long and extends to a depth of 6½ feet at mean low water; 550 feet of the shore end is built to a height of 11 feet above mean low water; the rest of the work is but 2 feet above mean low water, except a small pile 11 feet above that level in the middle of the low section and a larger pile at the end of the jetty, built 14 feet above mean low water to serve as a beacon.

The work done during the past year has been in repairing and extending the east jetty.

An appropriation of $8,000 was made by act of Congress passed August 2, 1882, and on September 27 proposals were opened for delivery of rip-rap stone. All offers made were deemed unreasonably high, and as it was then too late to begin the work in the fall, a second advertisement was deferred until the spring of 1883. April 24 proposals were again opened and a contract, dated June 6, 1883, was entered into with John Beattie, of Leetes Island, Conn., to deliver about 4,000 tons of rip-rap granite at the rate of $1.54½ per ton. The contractor began work June 6, and up to the close of the year 3,413 tons had been delivered in the east jetty, a small amount being used in repairs and the rest in adding 150 feet to its length. The contract expires July 31, 1883.

The last appropriation made was the amount estimated for completion of the project. It is by no means certain that the work has yet reached a permanent condition; it will not suffer injury, however, by a delay of one or two years, during which the effect of the jetties will be tested, and if it prove necessary a plan for continuance of the improvement can be prepared to better advantage. No appropriation is asked for for the fiscal year ending June 30, 1885.

Appropriations for the improvement of Port Jefferson Harbor, N. Y., have been made and expended as follows, viz:

Date.	Amount.	Application.
August 30, 1852	$1,200	Survey.
July 11, 1870	*Unknown.	Examination and report.
March 3, 1871	15,000	East jetty.
June 10, 1872	15,000	Do.
March 3, 1875	15,000	East and west jetties.
August 14, 1876	6,000	East jetty and dredging.
June 18, 1878	8,000	East and west jetties.
March 3, 1879	5,000	Dredging.
June 14, 1880	3,000	East and west jetties.
March 3, 1881	4,000	East jetty.
August 2, 1882	8,000	Do.
Total	80,000	

* Allotment from general appropriation for surveys.

Port Jefferson, a port of delivery in the collection district of New York, is on the north shore of Long Island, about 50 miles by a straight line east of New York City, and nearly opposite Bridgeport, Conn. There is a light-house on Old Field Point, just west of the harbor entrance. Fort Hale, New Haven Harbor, 23 miles distant, is the nearest work of defense.

I have as yet been unable to obtain any statement of the amount of commerce at Port Jefferson during the fiscal year ending June 30, 1883.

Money statement.

July 1, 1882, amount available		$421 31
Amount appropriated by act passed August 2, 1882		8,000 00
		8,421 31
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$486 05	
July 1, 1883, outstanding liabilities	5,273 08	
		5,759 13
July 1, 1883, amount available		2,662 18

Abstract of proposals opened September 27, 1882, for delivering rip rap stone at Port Jefferson Harbor, New York.

No.	Names and addresses of bidders.	Price.	Date of commencement.	Date of completion.	Remarks.
		Per ton.			
1	Luce & Hoskins, Niantic, Conn	$2 05	No date	June 30, 1883	Signatures not witnessed, bond not completed.
2	Frederick K. Ballou, Boston, Mass	1 94½	do	June 30, 1883	Signature of sureties not witnessed.

All proposals were rejected; prices being too high.

Abstract of proposals opened April 24, 1883, for delivering riprap stone at Port Jefferson Harbor, New York.

No.	Names and addresses of bidders.	Price.	Date of commencement.	Date of completion.	Remarks.
		Per ton.			
1	David V. Howell, New York, N. Y	$1 81	No date	July 31, 1883	
2	John Beattie, Leetes Island, Conn	1 54½	do	July 31, 1883	Bonds not completed.
3	Luce & Hoskins, Niantic, Conn	1 73	do	July 31, 1883	
4	Frederick K. Ballou, Mystic Bridge, Conn.	1 69	do	July 31, 1883	Bonds not certified.

Contract awarded to John Beattie; dated June 6, 1883; expires July 31, 1883.

D 14.

IMPROVEMENT OF GREENPORT HARBOR, NEW YORK.

In the report upon the survey of Greenport Harbor, made by Major Barlow, Corps of Engineers, in 1881, estimates were submitted for a breakwater from Joshua's Point, extending to the 12-foot, 15-foot, or 18-foot curve, to protect the point from erosion and to afford shelter to vessels anchored behind it. Work on the breakwater has just begun; it is designed to carry it out to 18 feet.

An appropriation of $10,000 was made for this improvement by act of Congress passed August 2, 1882, and proposals for delivery of riprap stone and construction of the shore end of the breakwater were opened April 24, 1883. A contract dated June 11, 1883, was entered into with Luce & Hoskins, of Niantic, Conn., to deliver stone and build the break-

water at the rate of $1.59 per ton. Work was begun June 11; 939 tons of stone were delivered at the close of the fiscal year, of which only 45 tons had been put in position in a finished part of the work, building 25 linear feet of the shore end. The shallowness of the water for the first 750 feet necessitates twice handling the stone and renders progress very slow. The contract expires September 30, 1883. The additional amount required to carry the breakwater out to the 18-foot curve is, according to the original estimate, $36,000. This amount could profitably be expended during the fiscal year ending June 30, 1885.

Appropriations for the improvement of Greenport Harbor, N. Y., have been made and expended as follows, viz:

Date.	Amount.	Application.
March 3, 1881	*$500	Survey.
August 2, 1882	10,000	Partly expended, shore end of breakwater.
Total	10,500	

*Allotment from general appropriation for surveys.

Greenport, situated on Shelter Island Sound, near the east end of Long Island, is a port of delivery in the collection district of Sag Harbor. The nearest light-house is on Long Beach Point, 3 miles to the eastward. The nearest work of defense is Fort Trumbull, New London Harbor, Connecticut, by a straight line 21 miles distant.

According to an estimate by the collector of customs for the district of Sag Harbor, there are about two hundred and seventy vessels registered at Greenport, having an aggregate tonnage of about 17,000. I have as yet been unable to obtain any further statement of the commerce of Greenport.

Money statement.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$157 09	
July 1, 1883, outstanding liabilities	71 55	
		228 64
July 1, 1883, amount available		9,771 36
Amount (estimated) required for completion of existing project		36,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		36,000 00

Abstract of proposals opened April 24, 1882, for delivering riprap stone at Greenport Harbor, N. Y.

No.	Names and addresses of bidders.	Price.	Date of commencement.	Date of completion.	Remarks.
		Per ton.			
1	D. V. Howell, New York	$1 87	May 1, 1883	No date	
2	John Beattie, Leetes Island, Conn	2 25	May 1, 1883	do	Bonds not completed.
3	Luce & Hoskins, Niantic, Conn	1 59	May 1, 1883	do	
4	Frederick K. Ballou, Mystic Bridge, Conn.	1 69	May 1, 1883	do	Bonds not completed.

Contract awarded to Luce and Hoskins; dated June 11, 1883; expires September 30, 1883.

Greenport Harbor, N. Y.

June 30, 1883.

Scale of Feet.

500 0 1000 2000

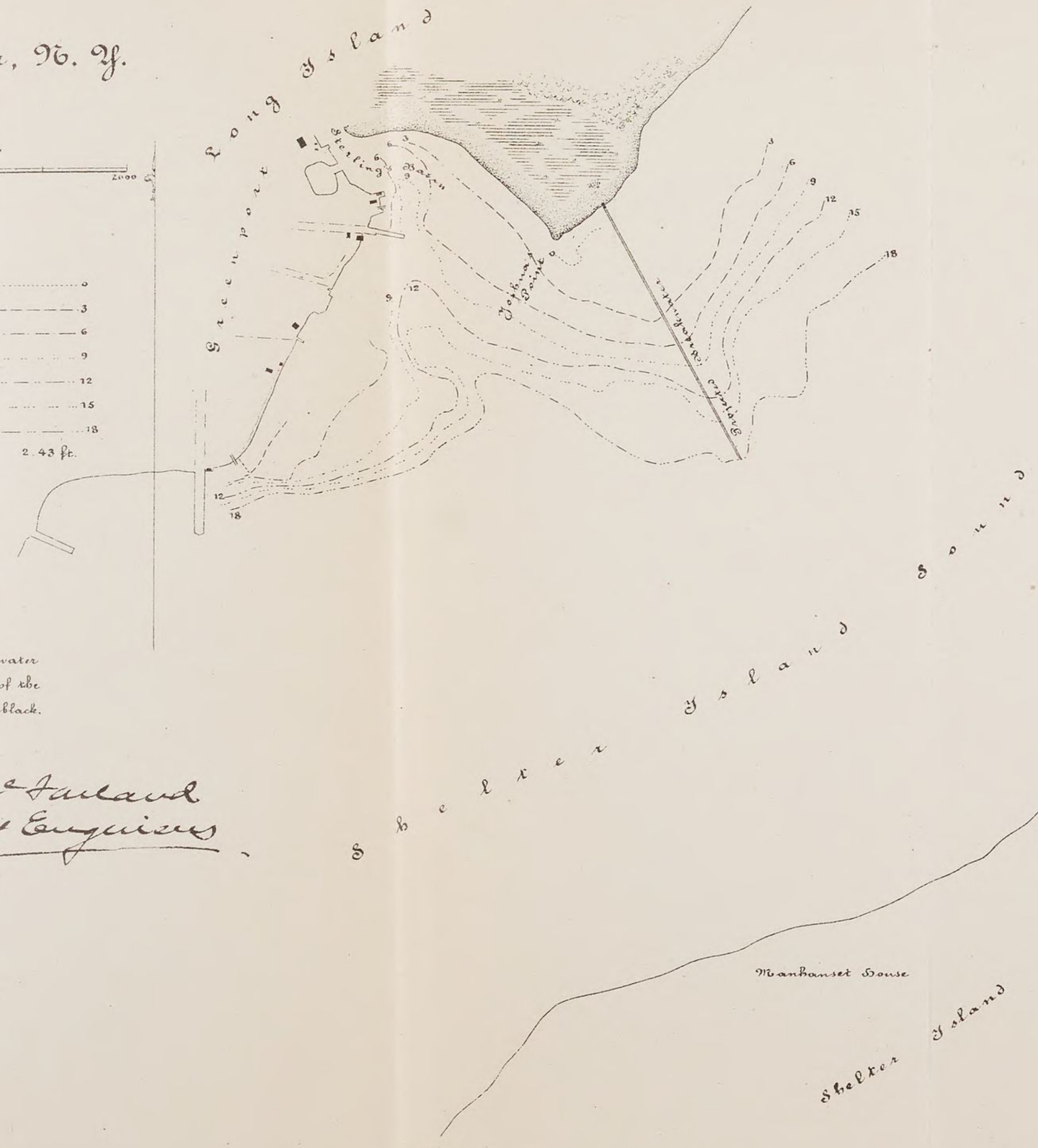
Contours are as follows:

Mean low water	0
3 foot curve	3
6 " "	6
9 " "	9
12 " "	12
15 " "	15
18 " "	18

Mean rise of tide 2.43 ft.

The location of the projected breakwater is shown by double lines; 25 feet of the shore end, completed, is shown in black.

Walter McFarland
Major of Engineers



APPENDIX E.

IMPROVEMENT OF HUDSON RIVER—REMOVAL OF OBSTRUCTIONS IN EAST RIVER AND HELL GATE—IMPROVEMENT OF BUTTERMILK CHANNEL, NEW YORK HARBOR; OF GOWANUS BAY AND HARLEM RIVER; OF THE HARBORS OF RONDOUT, ECHO, PORT CHESTER, AND NEW ROCHELLE, NEW YORK, AND OF RARITAN AND SOUTH RIVERS, NEW JERSEY.

REPORT OF COLONEL JOHN NEWTON, CORPS OF ENGINEERS, BVT. MAJ. GEN., U. S. A., OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1883, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Hudson River, New York.
2. Rondout Harbor, New York.
3. Removing obstructions in East River and Hell Gate, New York.
4. Buttermilk Channel, New York.
5. Harlem River, New York.
6. Gowanus Bay, New York.
7. Echo Harbor, New Rochelle, New York.
8. Harbor at New Rochelle, New York.
9. Port Chester Harbor, New York.
10. Raritan River, New Jersey.
11. South River, New Jersey.
12. Removal of sunken vessels obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
New York, July 30, 1883.

SIR: I have the honor to transmit herewith annual reports of the works under my charge during the fiscal year ending June 30, 1883.

Very respectfully, your obedient servant,

JOHN NEWTON,
Colonel of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

E 1.

IMPROVEMENT OF THE HUDSON RIVER, NEW YORK.

The project for the improvement of this river was adopted in 1867, and was modified in 1868, the object being to afford a navigable channel of 11 feet in depth at mean low water to Albany and 9 feet to Troy.

Under contract with Stanton & Doyle of July 30, 1881, to remove the reefs known as Austin's Rock, near Van Wies Point, work has been continued during the year under some disadvantages; the whole of the area of rocks Nos. 2, 3, 4, and 5, has been drilled, blasted, and dredged, and part of the area of No. 1, but the dredging machine has not succeeded in making the required depth of 12 feet at mean low water over the whole of Nos. 3, 4, and 5, which would entitle the contractors to their first payment. The sum of $37,000 is reserved for the contractors.

Under contract with William D. Fuller, of October 7, 1881, the following dikes were built: a full pile dike, 578 feet long, was built upon the line to connect the lower end of section 3, of Papscance Island, with the east shore; a cross-dike at Shad Island, 133 feet long; this completed the contract.

It was found necessary, owing to the existence of rock upon the line of the dike connecting the lower end of section 3 of Papscance Island with the shore, to build a crib 115 feet long; this was done by open purchase and hired labor, at a cost of $3.53 per linear foot, including the stone filling.

Repairs were made by hired labor to the high dike connecting Hillhouse and Patroons Islands; 119 feet of the dike was rebuilt and the height of the dike reduced to 3 feet above ordinary high-water over a distance of 547 feet.

The height of the dike was 5 feet above ordinary high-water, but it had been materially weakened by parties stealing the timber and iron, and as a natural consequence the dike broke through; the repairs amounted to $369.99.

During the year the State authorities made repairs to the State dikes just below Castleton and the one from Mull's Island to Houghtailing Island. They have also dredged between Troy and Albany and along the Overslaugh dike, and at Mull's.

This dredging was under the direction of the State engineer without consultation with this office.

The original condition of the navigable channel gave between New Baltimore and Barren Island a depth at mean low water of 7½ feet; at Coeyman's, 8½ feet; at Mull's, 9 feet; at Castleton, 8 feet; at Cedar Hill, 7½ feet; at Winnie's, 9.4 feet; on the Overslaugh, 7.7 feet; at Cuyler's Bar, 9 feet; at Round Shoal, 7.2 feet. That is, at low water, 7½ feet could be carried from New Baltimore to Albany, and from Albany to Troy, 7.2 feet.

The channels, however, were very crooked in places, very narrow, and of such difficult navigation that the grounding of boats was, it might almost be said, the rule and not the exception.

The originally adopted project for the improvement was the construction of longitudinal dikes, generally of the height of mean high water, to direct the currents, and allow the flow over their tops of freshets and of ice.

The amount expended to the close of the year ending June 30, 1882, was $938,336.71. No survey was made, and the condition of the improvement was supposed to be as stated in former reports.

The amount expended during the fiscal year ending June 30, 1883, was $5,465.31, and cross-dikes were completed at Shad Island and Papscance Island.

The available balance, $16,399.52, will be expended during the year ending June 30, 1884, in the construction of new dikes and necessary repairs to existing dikes.

The estimated amount required for the entire and permanent completion of the work of improvement in accordance with the project of 1868, and the work proposed in my report for the year ending June 20, 1882, is $65,102.46.

This work is in the collection district of New York, Albany being a port of entry.

The value of the imports for the fiscal year ending June 30, 1883, was $653,320, and the duties collected thereon $120,007.83.

The enrollment of the port for last year showed 769 vessels, with a tonnage of 91,058.4.

ESTIMATE.

Modified estimate of 1868	$984,304
Additional estimate of 1882	78,000
	1,062,304

AMOUNTS APPROPRIATED.

By act approved June 28, 1864	$33,000 00
By act approved June 23, 1866	50,000 00
By act approved March 3, 1867	305,188 00
By act approved July 25, 1868	85,000 00
By act approved April 10, 1869	89,100 00
By act approved July 11, 1870	40,000 00
By act approved March 3, 1871	40,000 00
By act approved June 10, 1872	40,000 00
By act approved March 3, 1873	40,000 00
By act approved June 23, 1874	40,000 00
By act approved March 3, 1875	40,000 00
By act approved August 14, 1876	50,000 00
By act approved June 18, 1878	70,000 00
By act approved March 3, 1879	30,000 00
By act approved June 14, 1880	20,000 00
By act approved March 8, 1881	15,000 00
By act passed August 2, 1882	10,000 00
	997,288 00
Received from other sources	648 24
	997,936 24
Deduct amount reverted to the Treasury	734 70
	997,201 54
Amount expended	943,802 02

Money statement.

July 1, 1882, amount available		$46,790 35
Amount appropriated by act passed August 2, 1882		10,000 00
		56,790 35
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,390 83	
July 1, 1883, outstanding liabilities	37,000 00	
		40,390 83
July 1, 1883, amount available		16,399 52
Amount (estimated) required for completion of existing project		65,102 46
Amount that can be profitably expended in fiscal year ending June 30, 1885		30,000 00

E 2.

IMPROVEMENT OF HARBOR AT RONDOUT, NEW YORK.

The act approved March 3, 1871, directed the survey of this harbor, and the results, with a project of improvement and estimate of cost, were reported January 25, 1872.

The original condition of the navigable channel gave a depth of about 7 feet at mean low water.

The originally adopted project was a prolongation of the channel of Rondout Creek into the Hudson River by the construction of two parallel dikes; also, of a branch dike to direct the current of the river and

to protect the north dike from the floating ice, and there has been no modification of the original project.

The amount expended to the close of the fiscal year ending June 30, 1882, was $88,731.31, and the depth in the channel was 13½ feet at mean low water.

There has been expended during the year ending June 30, 1883, the sum of $3,508.66, and repairs have been made to the dikes consisting of refilling with stone, replacing fender piles at end of north dike, and raising 600 feet of the south dike to the level of high water.

The estimated amount required for the entire and permanent completion of the work of improvement, in accordance with the approved and adopted project, would be about $2,000, to be used in widening the outlet between the dikes. It was intended to devote the $2,000 appropriated by act of Congress August 2, 1882, to this purpose, but the repairs and raising of the south dike exceeded the amount anticipated.

I consider the project virtually completed, and will require nothing more than the widening of the outlet between the dikes and the ordinary sum for preservation.

This work is in the collection district of New York; nearest port of entry, New York; amount of revenue collected during the fiscal year ending June 3, 1883, $147,901,488.93; amount of commerce and navigation benefited by the completion of this work, $70,000,000.

ORIGINAL ESTIMATE.

North dike	$41,600
Branch dike	34,400
South dike	59,600
Dredging channel	14,400
Contingencies and engineering	22,500
Total	172,500

AMOUNTS APPROPRIATED.

By act approved June 10, 1872	$10,000 00
By act approved March 3, 1873	20,000 00
Amounts allotted June 8, 1875:	
From repairs of harbors on Atlantic coast	762 18
From contingencies of rivers and harbors, &c	237 82
By act approved August 14, 1876	30,000 00
By act approved June 18, 1878	30,000 00
By act passed August 2, 1882	2,000 00
	93,000 00
Amount expended	92,239 97

Money statement.

July 1, 1882, amount available	$2,268 69
Amount appropriated by act passed August 2, 1882	2,000 00
	4,268 69
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,508 66
July 1, 1883, amount available	760 03
Amount (estimated) required for completion of existing project	2,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	2,000 00

IMPROVEMENT
OF
EAST RIVER AND HELL GATE
NEW YORK
REMOVAL OF
FLOOD ROCK

Sketch showing the condition of the excavation on
JUNE 30th 1883
to accompany Annual Report of
COL. JOHN NEWTON CORPS OF ENG'RS
BVT. MAJ. GEN. U.S.A.

Scale 1/1800
100 75 50 25 0 100 200 ft.

N

Great Mill Rock

Cribwork and Stone Dyke

Little Mill Rock

Negro Head

East Heading

E 3.

REMOVING OBSTRUCTIONS IN EAST RIVER AND HELL GATE, NEW YORK.

REEF AT HALLET'S POINT.

Some few points of broken rock having been found on this reef projecting above the required depth of 26 feet at mean low water, the small tender-scow was put to work on May 21, 1883, and continued at work until June 25, 1883, removing five shoal points; eighteen surface blasts were made, using 279½ pounds of number one powder, dynamite; the broken rock was removed by divers, some of it being rolled into deep water and some chained and deposited on the scow and then placed either on the shore or in deep water.

FLOOD ROCK.

Lieut. George McC. Derby has continued in superintendence of this work; his services have been characterized by efficiency and energy. Owing to the uncertainty in regard to the passage of the river and harbor bill of 1882, and in order to reserve a balance for the care and preservation of the work, operations were suspended from July 20 to August 21, 1882, when work was resumed under the appropriation of $200,000, passed August 2, 1882, and continued until March 31, 1883, when the force was reduced to about one-third the working capacity, and under this reduction continued until May 31, 1883, when it again became necessary to suspend all operations with the exception of the pumping.

During the year operations have been confined to completing the galleries, to reducing the roof of the cross-galleries to a thickness of about 15 feet, and to drilling the large holes for the final blast.

When work was suspended nearly all the roof holes had been drilled. During the year the length of galleries driven was 204.3 linear feet, and the quantity of rock removed from galleries and roof was 14,202.6 cubic yards, measured in place.

Since the commencement of this work the linear feet of headings driven amount to 20,180.9 feet, and the quantity of rock in place removed, to 70,347.9 cubic yards.

The progress of this work has been materially retarded during this year for the want of sufficient funds to carry on the operations with a sufficient force equal to the capacity of the plant. Now that operations are suspended it is necessary to continue running the pumps in order to keep the excavation from filling with water, and the cost of this is the same as when a full force is employed.

If the appropriations asked for in my report for the year ending June 30, 1882, had been granted this reef could have been blown up in September or October, 1883.

A sketch showing the progress of the excavation to the close of the year ending June 30, 1883, is transmitted herewith.

I append herewith the report of Lieutenant Derby, Corps of Engineers, superintendent of the work.

STEAM DRILLING SCOW.

At the beginning of the fiscal year the scow was at work upon Pot Rock, drilling and blasting, which was continued until July 19, when it became necessary to suspend operations for want of funds.

After the passage of the act of August 2, 1882, work was resumed on August 21, and continued until Sunday, the 27th instant, when the scow was collided with three times, as follows: the first about 6 o'clock in the morning, when a tug-boat with three barges loaded with coal, going to the eastward, struck the scow full on the bow, parting the three bow-chains; the second collision was about twenty minutes after the first, when a tug-boat with five canal-boats loaded with coal, going to the eastward, struck the scow and parted one of the stern chains; the third collision occurred about half-past six in the evening, when a tug-boat with six boats loaded with coal, going to the eastward, struck the scow in the port after quarter, carrying away the last centre chain.

After the morning collisions steam was got up on the steamers Star and General A. A. Humphreys to lie alongside the scow, and after the last collision they towed it to a place of safety in Hallet's Cove.

These collisions, while very injurious to the colliding vessels, did no great damage to the scow. Four of the six anchors and all but 90 feet of chain were recovered as soon as the scow was ready to go out; the trouble was the loss of time of about one week in getting ready to resume work.

After the anchors and chains had been picked up it was considered advisable to put the scow upon Frying Pan Reef, as the location of Pot Rock exposed the scow to so many collisions as to make it inexpedient to continue there. Ten collisions were encountered during the short time the scow was on Pot Rock, from June 19, 1882, to September 4, 1882.

On September 5, 1882, the scow was moored on Frying Pan Reef, and drilling, blasting, and removing broken rock were continued until January 13, 1883, when it became necessary, on account of the floating ice, to go into winter quarters.

The following improvements have been made in the working plant of the scow: One Clayton duplex air compressor, which with an air receiver, admits of four divers being at work at once, the compressor supplying the requisite amount of pure air; this is a great advantage over the system of using pumps worked by hand, both in economy and the quality of air; one new double end 10 by 12 cylinder hoisting engine was substituted for the old one, to gain more power in raising the broken rock.

After the scow was laid up in January some repairs were made to the machinery; the tender-scow was fitted up with a hoisting engine for removing small shoals and hoisting broken rock, and from May 21 to June 25 was used to remove the shoal points on Hallet's Point Reef.

As the available funds were very limited, no work was done by the steam-drilling scow since January 13, 1883, it being considered best to apply what money we had to the work on Flood Rock.

The original condition of the channel of East River and Hell Gate was the existence of many large and dangerous rocky obstructions to navigation. The depth over Diamond Reef at mean low-water was 17½ feet; over Coentie's Reef, 14.3 feet; over Frying Pan, 11 feet; over Pot Rock, 20 feet; over Heel Tap, 12.1 feet; over reef at the North Brothers, 16 feet; Hallet's Point from the shore at Astoria projected under water 325 feet to the contour line of 26 feet at mean low water, and embraced an area of about three acres. The Middle Reef with an area of about nine acres lay in the middle of the channels at Hell Gate, having a small backbone projecting above high water, and caught vessels swept upon it by the ebb currents, which passed directly over the rock. Hallet's Point and the Middle Reef may be said to have been alternate in mischievous functions, vessels which escaped one, ran a great risk of falling

upon the other. What added considerably to the danger from these reefs was the bend at right angles of the river at this spot.

The originally adopted project for the improvement was theleast extensive of three projects discussed by the engineer in charge. That one now being carried out was judged by the authorities in 1867 to be too extensive and costly. The project first adopted was the removal of Pot Rock, Frying Pan, Way's Reef, Shelldrake, the rock off Negro Point; the rocks near Wolsley's Bath-house, Blackwell's Rock, portions of Hallet's Point, and Sealy Rock. Sea-walls were designed for the Middle Reef, Hog's Back, the Bread and Cheese, and a beacon for Rylander's Reef.

The project most favored by the engineer in charge, which included likewise the total removal of Hallet's Point and of the Middle Reef, has, as time passed, received the approval of the authorities.

The project first intended solely for Hell Gate has also been modified by incorporating with it rocky obstructions in the East River, Diamond Reef, Coenties Reef, and a reef near the North Brothers.

The amount expended thereon to the close of the fiscal year ending June 30, 1882, was $2,930,418.98.

The condition of the improvement was the removal of Diamond, Coenties, and Way's reefs and Shelldrake to a depth of 26 feet at mean low-water; the breaking up of Heel Tap Rock, the tunneling and explosion of Hallet's Point, and the removal of the *débris* to the depth of 26 feet at mean low water; the tunneling of the Middle Reef (Flood Rock) to the extent of 19,975.87 linear feet and the removal therefrom of 56,145.3 cubic yards of stone, measured in place; the removal of the reef off the North Brothers Island to the depth of 26 feet at mean low water.

The amount expended during the year ending June 30, 1883, was $206,526.30.

Some loose rock has been removed from Hallet's Point Reef; drilling and blasting on Pot Rock and Frying Pan Reefs; and the tunnels of the Middle Reef (Flood Rock) were driven 204.03 linear feet and 14,202.6 cubic yards of stone, measured in place, removed, and nearly all the roof-holes for the final blast had been drilled.

During the year ending June 30, 1884, the available balance will be sufficient only for the care and preservation of the work and running the pumps to keep the excavation on Flood Rock from filling with water.

The estimated amount required for the entire and permanent completion of the work of improvement in accordance with the approved and adopted project is $1,963,029.67.

This work is in the collection district of New York. The nearest port of entry is New York City. The amount of revenue collected during the year ending June 30, 1883, $147,901,488.93. The amount of commerce and navigation benefited by the completion of this work, about $4,000,000,000 daily.

ORIGINAL ESTIMATE.

Removing reefs at Hell Gate and Diamond and Coenties Reefs, $5,139,120.

AMOUNTS APPROPRIATED.

By act approved July 25, 1868	$85,000 00
By act approved April 10, 1869	178,300 00
By act approved July 11, 1870	250,000 00
By act approved March 3, 1871	250,000 00
By act approved June 10, 1872	225,000 00
By act approved March 3, 1873	225,000 00
By act approved June 23, 1874	225,000 00
By act approved March 3, 1875	250,000 00

By act approved August 14, 1876		$250,000 00
By act approved June 18, 1878		350,000 00
By act approved March 3, 1879		250,000 00
By act approved June 14, 1880		200,000 00
By act approved March 3, 1881		200,000 00
By act approved May 4, 1882		50,000 00
By act passed August 2, 1882		200,000 00
		3,188,300 00
Received from other sources		1,948 88
		3,190,248 88
Deduct amount reverted to United States Treasury	$3,158 55	
Deduct amount allotted to Harlem River	11,000 00	
		14,158 55
		3,176,090 33
Amount expended		3,136,945 28

AMOUNTS EXPENDED DURING THE YEAR ENDING JUNE 30, 1883.

Removing reef at Hallet's Point	$398 25
Excavations at Flood Rock	161,894 02
Steam drilling-scow, operating on Pot Rock and Frying Pan	44,234 03
	206,426 30

Money statement.

July 1, 1882, amount available		$25,623 35
Received from sale of fuel to Lieutenant Derby		48 00
Amount appropriated by act passed August 2, 1882		200,000 00
		225,671 35
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$186,526 30	
July 1, 1883, outstanding liabilities	3,324 63	
		189,850 93
July 1, 1883, amount available		35,820 42
Amount (estimated) required for completion of existing project		1,963,029 67
Amount that can be profitably expended in fiscal year ending June 30, 1885		*500 000 00

REPORT OF LIEUTENANT GEORGE M'C. DERBY, CORPS OF ENGINEERS.

ASTORIA, N. Y., *July* 1, 1883.

GENERAL: In compliance with your directions, I have the honor to submit herewith a tabulated statement of the amount and cost of work done at Flood Rock, East River, during the fiscal year just closed.

Owing to the insufficiency of the appropriation, all work was suspended by your order from July 20 to August 21, and from May 31 to June 30; and from March 31 to May 31 the work was carried on at one-third the capacity of the plant. The progress reported is, therefore, rather less than nine months' work. These interruptions and delays are greatly to the disadvantage of the work, as the expense of pumping and superintendence goes on whether any progress is being made in the mine or not, and the liability to being thrown out of work for one or more months during the year causes a certain degree of recklessness on the part of the workmen that is incompatible with maximum efficiency.

On account of the uncertainty about the appropriation, you directed me to make no attempt to cut through the heavy leak at the north end of the work. The progress has, therefore, been confined to finishing the other galleries, to stoping down the roof of the cross-galleries to a thickness of about 15 feet, and to drilling the large

*Of this amount $360,000 is the estimated cost of blowing up the reef; $60,000 for extending certain galleries to embrace the whole area to be removed, and the balance, $80,000, for the removal of other reefs in the East River and Hell Gate. It is useless, of course, to appropriate any sum less than the cost of the explosion.

holes for the final blast. The first item was completed November 16, the second April 3, and when work was suspended nearly all the roof-holes for the final blast had been drilled. The number of holes to be put in the pillars has not yet been definitely determined.

DRILLING.

We started at the beginning of the year, offering a small prize to excite competition between the drillers, and soon changed to paying three rates of wages to drillers and helpers, instead of a uniform rate, with a regular system of promotion through the six grades thus established. The results obtained were very satisfactory, raising the averages as compared with last year's from 13.32 feet per shift to 16.23 on 3-inch holes, from 21.22 to 22.42 on 2-inch stoping holes, and from 28.0 to 29.4 on the drilling in the headings. These latter figures are not a true measure of the gain, however, as all of the 204 feet of galleries driven during the year were in the hard rock at the north end.

* * * * * * *

BLASTING.

At the beginning of the year I finished a series of tests of the principal powders obtainable in this market, resulting in the selection of Warren's gelatine blasting powder, which, pound for pound, was 20 per cent. more effective and 28 per cent. less expensive than the powder we had been using. Owing to some complication about the gelatine patent, however, the use of this explosive was discontinued by your order in October, and Hercules powder, the next most advantageous of those tested, was used until the Giant Powder Company reduced their price from 45 cents a pound to 33 cents for the powder we had formerly used.

The number of pounds of powder used per yard of rock broken from the headings is higher than last year, because the 516 yards removed were all from the hard rock at the north end. In stoping, the same thing is observable, partly for the same reason, but principally because the finished stopes are quite high and narrow, and once the roof of the gallery has been raised a few feet above the tops of the galleries that cross it, a charge of powder will not throw down as much rock as it will on the first two or three rounds, where the roof does not get the support of the adjacent walls, and the fracture has a chance to spread. This necessitates not only more powder but more drilling per cubic yard of rock, and increases the cost of excavation proportionally.

The same effect is more noticeable still in comparison with the work done at Hallet's Point, where the galleries were wider and not so high, and the roofs of both sets of galleries were stoped to the same height. The decrease in the number of cubic yards to be removed under the system pursued at Flood Rock, however, far more than compensates for the increased cost per yard.

We have had no accidents during the year.

* * * * * * *

DUMPING.

We have continued to dump in the deep hole just north of Blackwell's Island. Soundings taken in March gave no depths less than 70 feet.

PUMPING.

Large quantities of water have been cut during the year, both in reducing the roor and in drilling for the final charge; but the strictest attention has been paid to keeping every leak as tight as possible, and the leakage at present only amounts to 737 gallons per minute at half tide, which is scarcely as much as it was a year ago.

* * * * * * *

VENTILATING.

The ventilating fan was stopped March 31, the galleries having been so far enlarged as to ventilate themselves sufficiently.

TIMBERING.

With a view to making the amount of timbering as small as possible, all the stoping has been confined to the galleries that run across the stratification of the rock. Very little timbering has been found necessary, but large sections of the work where the rock is treacherous require constant watching and should not be left standing any longer than is absolutely necessary.

TRANSPORTATION.

The boiler of tug Humphreys has required extensive repairs and she was laid up from March 3 to May 10 on that account.

SURVEYING.

The regular monthly surveys, and the locating and plotting of the holes drilled for the final blast, have been done by Mr. G. W. Kuehnle, assisted by Mr. J. M. Gore. Their services have been in the main highly satisfactory.

* * * * * * *

The total number of cubic yards of rock removed from Flood Rock up to date is 70,347.9, and the total length of galleries driven is 20,180.9 feet.

To prepare the mine for the final blast there remain about 4,800 feet of 3-inch holes to be drilled in the roof and all of the holes in the pillars; about 6,500 cubic yards of broken stone to be removed; and about three-quarters of an acre to be tunneled and completed, provided the water does not prevent our reaching it. This amount of work can be done in five months if we are not too much delayed cutting leaks.

Very respectfully, your obedient servant,

GEO. MCC. DERBY,
Lieutenant of Engineers.

Col. JOHN NEWTON,
Corps of Engineers, U. S. A.

Tabulated statement of amount of work done at Flood Rock, Hell Gate, East River, New York, during fiscal year ending June 30, 1883.

Application.	Drilling.	Blasting.	Hauling.	Hoisting.	Dumping.	Pumping.	Ventilating.	Timbering.	Transportation.	Surveying.	Repairs to plant.	Superintendence.	Total.
Number of men employed	90	3	33	2	2	4	1	2	4	5	12	8	166
Number of shifts of eight hours worked	22, 395. 25	584. 25	8, 264. 25	581	461. 125	1, 271. 875	193. 875	546. 75	1, 233. 75	1, 212. 125	3, 683. 125	2, 804. 25	43, 231. 625
Amount drilled in feet:													
2-inch holes	99, 850. 75											99, 850. 75	
3-inch holes	65, 146. 75											64, 146. 75	
Amount drilled per machine per shift of eight hours:													
2-inch holes ..... feet	22. 98												
3-inch holes ..... do	19. 49												
Number of drills sharpened	47, 313											47, 313	
Number of feet of drilling per cubic yard of rock broken:													
Headings, 10 by 6 feet	19. 48												
Stoping	6. 56												
Number of 2-inch holes drilled and fired	22, 203	22, 176											
Number of pounds of explosives used per cubic yard of rock broken:													
Headings, 10 by 6 feet		3. 62											
Stoping		1. 39											
Total number of pounds of explosives used, viz: Gelatine, Hercules, New No. 1, and Racharock:													
Headings, 10 by 6 feet		1, 874											
Stoping		19, 017											
Large broken rock		288										21, 179	
Number of cubic yards of rock broken and removed:													
Headings, 10 by 6 feet		516. 86											
Stoping		13, 685. 74	14, 319. 32	14, 319. 32	14, 319. 32							14, 202. 6	
Linear feet of galleries driven	204. 3											204. 3	

REMARKS.—Loss of steel by abrasion and dressing, 2,366 pounds. The only addition made to the plant are two wooden buckets to assist the pumps in case of emergency. The additions charged to drilling are the large drills received and reported last year, the bill for which had not been received at the end of the year.

Respectfully submitted.

GEO. MCC. DERBY,
Lieutenant of Engineer.

Col. JOHN NEWTON,
Corps of Engineers, U. S. A.

Tabulated statement of cost of work done at Flood Rock, Hell Gate, East River, New York, during fiscal year ending June 30, 1883.

Application.	Drilling.	Blasting.	Hauling.	Hoisting.	Dumping.	Pumping.	Ventilating.	Timbering.	Transportation.	Surveying.	Superintendence.	Total.	Cost of sharpening drills.	
													2-inch drills.	3-inch drills.
Addition to plant:														
Material	$1,093 94	.....	.....	.....	.....	$48 71	.....	.....	.....	.....	.....	$1,142 65	$0.05	$0.09
Wages	11 25	.....	.....	.....	.....	86 63	.....	.....	.....	.....	.....	97 88	.....	.....
Repairs to plant:														
Material	4,975 87	.....	$197 75	$217 69	$19 50	563 23	$66 94	.....	$595 79	$37 00	$16 50	6,690 27	.....	.....
Wages	6,450 05	$4 03	733 55	276 49	240 38	1,173 45	44 22	.....	1,005 36	10 50	3,845 96	13,783 99	.....	.....
Operating expenses:														
Material	10,838 57	8,228 34	1,487 89	1,788 62	.....	5,344 50	205 21	.....	1,103 99	48 17	790 16	29,835 45	.....	.....
Wages	53,149 53	1,606 12	17,032 05	1,354 17	860 65	2,639 24	291 99	$1,233 20	3,253 97	3,902 91	6,211 57	91,536 30	.....	.....
Total expenses	76,519 21	9,838 49	19,452 14	3,636 97	1,120 53	9,855 76	608 36	1,233 20	5,959 11	3,998 58	10,864 19	143,086 54	.....	.....
Cost of breaking a cubic yard of rock:														
Headings, 10 by 6 feet	6.652	1.684	.....	.....	.....	0.623	0.29	0.077	0.132	0.355	0.687	10.239	.....	.....
Stoping	2.831	0.645	.....	.....	.....	0.273	0.017	0.034	0.058	0.156	0.301	4.315	.....	.....
Cost of removing a cubic yard of rock	.....	0.009	1.358	0.254	0.078	0.198	0.012	0.025	0.312	.....	0.218	2.464	.....	.....
Cost of drilling for final charge	34,325 87	.....	.....	.....	.....	2.952 28	183 38	368 39	625 71	1,679 51	3,247 73	43.383 17	.....	.....
Cost per linear foot of 2-inch holes:														
Heading, 10 by 6 feet	0.341	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Stoping	0.431	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cost per linear foot of 3-inch holes	0.535	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Respectfully submitted.

GEO. McC. DERBY,
Lieutenant Engineers.

Col. JOHN NEWTON,
Corps of Engineers, U. S. A.

Tabular statement of operations of the United States steam drilling scow, from June 19, 1882, to January 13, 1883.

Operations.	Pot Rock June 19, August 27.	Frying Pan September 25, 1882, January 12, 1883.
Cubic yards of rock and bowlders removed	94.5	571.83
Pounds of cast iron removed	.....	15,635.83
Total number of holes drilled	65	84
Total number of feet drilled	553.6	553.08
Average depth of holes ..... feet	8.5	6.6
Size of drilling bit ..... inches	5¾	5¾
Average number of feet of holes drilled by each machine per shift of eight hours	9.07	7.96
Average cost of sharpening a drill	$1 72	$1 72
Average number of feet drilled to each sharpening	8.5	6.6
Expenditure of steel to each foot of hole drilled ..... ounces	0.94	1.2
Average cost of linear foot of hole drilled, including placing of scow, lowering of dome, expenses of drilling, cost of sharpening drills, expenditure of steel, hoisting up dome after drilling operations, and heaving off scows	$0 91	$1.16
Number of drill-hole blasts	5	8
Amount of powder used for drill-hole blasts ..... pounds	2,602.5	2,988
Average number of pounds of powder to each cubic yard	.....	5.95
Average cost of powder to each cubic yard of rock removed	.....	$2 08
Cost per cubic yard of rock removed	.....	$47 26
Average amount of powder per foot of drill hole ..... pounds	4.7	5.4
Cost of powder to foot of drill hole	$1 64	$1.89
Number of surface blasts	.....	4
Amount of powder used for surface blasts ..... pounds	.....	415

The average number of pounds of powder to each cubic yard, cost of powder to each cubic yard of rock removed, and the cost per cubic yard of rock removed for Pot Rock cannot be given, as the rock broken by blast was not picked up.

The cost per cubic yard of rock removed for Frying Pan appears large, but will be greatly reduced when the broken rock is all picked up.

Tabulated statement of the commerce of the port of New York for the years 1879, 1880, 1881, *and* 1882.

VESSELS ENTERED.

Years.	Coastwise.		American.		Foreign.		Total.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
1879	2,014	1,716,155	2,397	1,244,803	5,172	5,417,022	9,583	8,377,980
1880	2,255	1,928,585	2,366	1,309,809	5,775	6,304,482	10,396	9,539,867
1881	.....	.....	1,964	1,116,841	5,193	6,389,681	7,157	7,506,522
1882	.....	.....	1,806	1,075,682	4,719	6,285,161	6,525	7,360,843

VESSELS CLEARED.

Years.	Coastwise.		American.		Foreign.		Total.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
1879	3,135	2,068,817	1,966	1,107,313	4,991	5,297,534	10,092	8,473,664
1880	3,908	2,514,955	1,743	1,086,930	5,641	6,342,872	11,292	9,944,757
1881	.....	.....	1,630	1,037,562	5,297	6,476,046	6,927	7,513,608
1882	.....	.....	1,374	892,730	4,806	6,337,435	6,120	7,263,194

Tabulated statement of the commerce of the port of New York, &c—Continued.

NUMBER AND TONNAGE OF STEAM AND SAILING VESSELS, BARGES, AND CANAL-BOATS BELONGING TO THE PORT OF NEW YORK.

Years.	Sailing vessels.		Steam vessels.		Barges.		Canal-boats.		Total.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
1879.....	2, 623	579, 804. 11	796	289, 477. 74	536	129, 045. 30	404	32, 314. 13	4, 359	1, 025, 641. 28
1880.....	2, 495	548, 186. 84	824	290, 674. 46	402	79, 195. 80	402	32, 000. 62	4, 123	960, 057. 72
1881.....	2, 499	532, 998. 99	894	303, 393. 71	408	81, 267. 95	425	34, 034. 42	4, 256	951, 685. 07
1882.....	2, 444	518, 693. 96	954	325 427. 03	432	84, 537. 87	172	16, 988. 47	4, 002	945, 646. 33

VALUE OF EXPORTS, IMPORTS, AND DUTIES COLLECTED AT PORT OF NEW YORK.

Year ending December 31.	Exports.	Imports.	Duties.
1879	$371, 046, 609	$424, 189, 123	$96, 817, 543 06
1880	425, 193, 099	539, 386, 776	130, 431, 007 56
1881	385, 760, 201	495, 424, 906	138, 360, 312 45
1882	394, 501, 862	499, 928, 774	151, 529, 892 82

E 4.

IMPROVEMENT OF BUTTERMILK CHANNEL, NEW YORK.

The project and estimate for this work was submitted March 27, 1880, as an indorsement upon a communication of the Hon. Levi P. Morton to the Chief of Engineers.

The contract made October 15, 1881, with Henry Du Bois & Sons, which was in force at the beginning of the year, was completed December 5, 1882. The quantity of material removed from the 1st of July to the completion of the contract was 166,350 cubic yards.

Under the appropriation of August 2, 1882, a contract was made with Henry Du Bois's Sons on December 4, 1882, at 22 cents per cubic yard, measured in scows, for continuing the dredging of the shoal. Under this contract work was commenced on March 24, 1883, and at the end of the year 66,025 cubic yards of material had been removed. The total number of cubic yards removed to the close of the year was 232,375. The channel in its original condition was obstructed by a large shoal, with a minimum depth of 9½ feet at mean low water, which lay in the direct track of navigation, too near the wharves of Brooklyn for the safe passage or maneuver of large vessels.

The originally adopted project for the improvement was the removal of a sufficient portion of this shoal to the depth of 26 feet at mean low water, and thereby to increase the depth and width of the channel.

The amount expended to the close of the fiscal year ending June 30, 1882, was $62,807.29.

The removal of an increased portion of the shoal was received with a great deal of satisfaction by the shipping interests of this city and Brooklyn, as it greatly facilitated the movements of large vessels coming to this port.

The amount expended during the fiscal year ending June 30, 1883, was $56,355.57, and as the removal of the shoal continues the benefit to commerce and navigation is proportionately increased.

The available balance, $60,837.14, will be expended in continuing the dredging during the year ending June 30, 1884.

The estimated amount required for the entire and permanent completion of the work in accordance with the revised estimate submitted in my report for the year ending June 30, 1881, is $30,000.

The amount of commerce and navigation interested in this improvement is very great, though impossible to be furnished accurately, since it forms a part not easily separated from the rest of the commerce of the port of New York.

Just in the neighborhood of this work there are large storehouses and grain elevators.

This work is in the collection district of New York. The nearest port of entry is New York City.

The amount of revenue collected during the fiscal year ending June 30, 1883, $147,901,488.93; amount of commerce benefited by the completion of this work is about $1,500,000 daily.

ORIGINAL ESTIMATE.

For dredging 570,000 cubic yards	$140,000 00

AMOUNTS APPROPRIATED.

By act approved June 14, 1880		60,000 00
By act approved March 3, 1881		60,000 00
By act passed August 2, 1882		60,000 00
		180,000 00
Amount expended		119,162 86

Money statement.

July 1, 1882, amount available		$49,272 71
Amount appropriated by act passed August 2, 1882		60,000 00
		109,272 71
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$48,435 57	
July 1, 1883, outstanding liabilities	7,665 00	
		56,100 57
July 1, 1883, amount available		53,172 14
Amount (estimated) required for completion of existing project		30,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		30 000 00

Abstract of bids for dredging shoal in Buttermilk Channel, New York, opened November 25, 1882.

Bidders.	Price, measured in scows.
	Per cu. yd.
Henry Du Bois's Sons	$0 22
Morris & Cumings Dredging Company	38

Contract awarded to Henry Du Bois's Sons; dated December 4, 1882, to be completed Jannary 1. 1884.

E 5.

IMPROVEMENT OF THE HARLEM RIVER, NEW YORK.

The survey of this work was directed by the act approved June 23, 1874, and on February 18, 1875, I reported a project and estimate for the improvement of the river from Randall's Island to the Hudson River.

The commissioners appointed by the supreme court of the State to secure the right of way, free of cost, to the United States for the proposed cut or canal to connect the Harlem and Hudson rivers, have made their report to the court, where the matter now rests.

The lines of the improvement are given in my report for the year ending June 30, 1882.

This work is in the collection district of New York. Nearest port of entry, New York City.

Amount of revenue collected during the fiscal year ending June 30, 1883, $147,901,488.93. Amount of commerce to be benefited by this work will be very large.

ORIGINAL ESTIMATE.

For 15-foot channel	$2,100,000

AMOUNTS APPROPRIATED.

By act approved June 8, 1878	300,000
By act approved March 3, 1879	100,000
	400,000

Money statement.

July 1, 1882, amount available	$400,000 00
July 1, 1883, amount available	400,000 00
Amount (estimated) required for completion of existing project	1,700,000 00

E 6.

IMPROVEMENT OF GOWANUS BAY, NEW YORK.

The survey of this bay was directed by the act approved June 14, 1880, and the results, with a project of improvement and estimates of cost, were reported January 11, 1881.

The contract made July 30, 1881, with John W. Ambrose & Co. was continued until October, 1882, 60,708 cubic yards of material being removed since July 1, 1882, and the contract closed.

The total amount of material removed under this contract was 201,788 cubic yards, at 17 cents per yard.

No operations have been conducted under the appropriation of August 2, 1882, of $20,000, owing to legal formalities for securing the right of way across private property at the southwest corner of Erie Basin, decision upon which was not received until May 23, 1883.

The original condition of the channel was inadequate for the navigation of vessels employed in the commerce of this district, the depth of water varying from 6.9 feet to 12.3 feet at mean low water.

The originally adopted plan was to dredge a channel from the 18-foot contour outside the bay to the draw-bridge at Hamilton Avenue. The estimated cost was $182,850. It has been recommended to the Department to dredge the existing channel from Hamilton Avenue to the southwest corner of Erie Basin, and thence to divide it into two branches, one to the north and one to the south. The cost of this revised project will be $192,564.90.

The amount expended at the close of the year ending June 30, 1882, was $23,834.83, and a channel dredged 4,374 feet long, 100 feet wide, and 18 feet deep.

The amount expended during the year ending June 30, 1883, was

$16,289.48, and a channel dredged 1,826 feet long, 100 feet wide, and 18 feet deep at mean low water.

During the fiscal year ending June 30, 1884, it is proposed to devote the available balance, $19,875.69, to widening and deepening the channel of the south branch of the improvement, and to widening and deepening the channel from Erie Basin towards Hamilton Avenue Bridge.

The estimated amount required for the entire and permanent completion of the improvement in accordance with the approved and adopted project is $123,000, and for the proposed revised project $132,564.90.

The commerce and navigation of this place is substantially the same as given in my last report, with an increase in the manufacture of petroleum oils.

This work is in the collection district of New York. Nearest port of entry, New York City; nearest light-house, Robbins Reef.

Amount of revenue collected during the fiscal year ending June 30, 1883, $147,901,488.93. Amount of commerce and navigation to be benefited is about $5,000,000.

ORIGINAL ESTIMATE.

530,000 cubic yards of dredging, at 30 cents	$159,000
Engineering and contingencies	23,850
	182,850

AMOUNTS APPROPRIATED.

By act approved March 3, 1881	40,000 00
By act passed August 2, 1882	20,000 00
	60,000 00
Amount expended	40,124 31

Money statement.

July 1, 1882, amount available	$9,970 03
Amount appropriated by act passed August 2, 1882	20,000 00
	29,970 03
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	10,094 34
July 1, 1883, amount available	19,875 69
Amount (estimated) required for completion of existing project	122,850 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	30,000 00

E 7.

IMPROVEMENT OF ECHO HARBOR, NEW ROCHELLE, NEW YORK.

The survey for this work was directed by the act approved March 3, 1875, and the project of improvement, with estimates of cost, reported December 20, 1875.

Echo Harbor is a well sheltered expanse of water, being land-locked on all sides except the southeast, where it opens into Long Island Sound.

The improvement designated was the removal of two reefs, Start Rock and Sheepshead Rock. The amount of the estimate was $38,955.38, and it was reported that such improvement would be for the benefit of local commerce.

The contract made July 12, 1882, with George W. Townsend, for the removal of a part of Sheepshead Reef, was completed in September, 1883, and consisted of 506 cubic yards, spread over an area of 516 square yards, removed to a depth of 9 feet below mean low water, the cost being $8,000.

The original condition of navigation showed rocky obstructions, Start Rock and Sheepshead Rock; the former exposed in part at low water, and the latter with a least depth over it at mean low water of 1 foot.

The originally adopted project was the removal of these rocks, the former to 6 feet at mean low water, and the latter to 9 feet. A change of project was made by increasing the depth of removal of Start Rock to 7 feet at mean low water.

The amount expended to June 30, 1882, was $10,508.37, and the condition of the improvement was the removal of Start Rock to the depth of 7 feet at mean low water.

The amount expended during the fiscal year ending June 30, 1883, was $8,126.26, and has resulted in the removal of a portion of Sheepshead Reef.

The balance on hand, $3,366.37, is too small to continue work on Sheepshead Reef.

I am informed that the work which has been done thus far has improved the navigation, and gives general satisfaction to the community, and has been the means of a reduction in the rates of freight. The inhabitants desire the entire removal of Sheepshead Reef, as further facilitating the business of New Rochelle, and rendering it less difficult to charter vessels for freight to and from this place.

All the commerce of New Rochelle is transacted through this harbor, and for the fiscal year ending June 30, 1883, the following list, which was obtained from the best available sources, will show the quantity of merchandise received:

Articles.	Quantity.	Value.
Cement.....tons..	1,000	$14,000
Lime.....barrels..	2,000	2,000
Brick.....tons..	6,000	24,000
Coal.....do...	10,000	60,000
Lumber.....feet..	2,000,000	60,000
Bluestone.....tons..	3,000	6,000
Flagging.....do...	6,000	4,500
Fertilizers.....do...	500	1,250
Total.....	.....	171,750

In addition to this, a propeller of 100 tons burden makes daily trips between this port and New York City.

ORIGINAL ESTIMATE.

Removing Sheepshead Rock	$21,201 75
Removing Start Rock	12,672 50
Contingencies	5,081 13
Total	38,955 38

This work is in the collection district of New York. Nearest port of entry, New York. Nearest light-house, Execution Rock.

Amount of revenue collected for the year ending June 30, 1883, $147,901,488.93. Amount of commerce to be benefited by the completion of this work, $1,500,000.

AMOUNTS APPROPRIATED.

By act approved June 18, 1878	$10,000 00
By act approved March 3, 1879	3,000 00
By act approved June 14, 1880	3,000 00
By act approved March 3, 1881	3,000 00
By act passed August 2, 1882	3,000 00
Total	22,000 00
Amount expended	18,633 63

Money statement.

July 1, 1882, amount available	$491 63
Amount appropriated by act passed August 2, 1882	3,000 00
	3,491 63
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	125 26
July 1, 1883, amount available	3,366 37
Amount (estimated) required for completion of existing project	16,955 38
Amount that can be profitably expended in fiscal year ending June 30, 1885	17,000 00

E 8.

IMPROVEMENT OF HARBOR AT NEW ROCHELLE, NEW YORK.

The act approved June 14, 1880, directed the survey of this harbor, and the results, with a project of improvement and estimates of cost, were reported January 28, 1881.

The contract made July 31, 1881, with Emory R. Seward, for the removal of a rock lying in the outlet of the channel around Glen Island, has not been completed.

An examination of the rock was made in January, 1883, and again in April, 1883, and a number of points were found projecting above the required depth of 8 feet, varying from one foot to one-half foot. Since then an examination was made by one of our divers, and the deficiency in depth was found to extend over nearly the whole of the rock.

The original condition of the channel was narrow and interspersed with sunken reef of rocks, which made it dangerous for navigation, and in the channel proposed to be excavated by dredging the depth varied from 0 to 8 feet at mean low water.

The originally adopted project was to remove rocky obstructions and dredge an inner channel between Hunter's and Flat Islands. The estimated cost was $40,825, and this project has not been modified.

The expenditures up to June 30, 1882, were $9,275.43, and a channel had been dug around Glen Island 100 feet wide and 6 feet deep at mean low water.

The expenditures during the year ending June 30, 1883, were $307.97, and were principally for surveys.

Authority having been received by letter from the Chief of Engineers, of June 21, 1883, to undertake the removal of "Corning Rock" with the steam drilling scow, it is proposed early in July to commence operations on this rock.

The estimated sum required for the entire and permanent completion of the work of improvement in accordance with the approved and adopted project is $5,825.

The interests to be benefited by the improvement were stated in report of January 28, 1881, containing the projects and estimates, in these words:

> The improvement indicated by the present survey refers to that part of New Rochelle Harbor contiguous to Glen and Flat islands, upon which buildings adapted to the purposes of a summer resort have been erected. A number of steamers convey excursionists during the warm season to these islands, and it is understood that the objects of the examinations just made of the channels is to prepare safe and convenient lines of approach and departure from the islands selected for the purposes named. Commerce and trade with New Rochelle have apparently little to do with the proposed improvement.

The amount of tonnage of the steamers and barges conveying the excursionists to the islands named is not known. The trips, however, are frequent, and the number of passengers large.

New Rochelle Harbor is the collection district of New York. Nearest port of entry, New York City; nearest light-house, Execution Rock, Long Island Sound.

Amount of revenue collected during fiscal year ending June 30, 1883, $147,901,488.93.

ORIGINAL ESTIMATE.

Removal of the Corning Rock:		
150 cubic yards of excavation, at $40	$6,000	
Engineering and contingencies	900	
		$6,900
Dredging inner channel and removing rock:		
45,000 cubic yards of dredging, at 30 cents	13,500	
300 cubic yards rock excavation, at $20	6,000	
Engineering and contingencies	2,925	
		22,425
Removal of Rock C, east of Flat Island Dock:		
400 cubic yards rock excavation, at $25	10,000	
Engineering and contingencies	1,500	
		11,500
Total		40,825

AMOUNTS APPROPRIATED.

By act approved March 3, 1881	20,000 00	
By act passed August 2, 1882	15,000 00	
		35,000 00
Amount expended	9,814 55	

Money statement.

July 1, 1882, amount available	$10,493 42	
Amount appropriated by act passed August 2, 1882	15,000 00	
		25,493 42
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$307 97	
July 1, 1883, outstanding liabilities	9,000 00	
		9,307 97
July 1, 1883, amount available		16,185 45
Amount (estimated) required for completion of existing project	5,825 00	
Amount that can be profitably expended in fiscal year ending June 30, 1885.	6,000 00	

E 9.

IMPROVEMENT OF PORT CHESTER HARBOR, NEW YORK.

The act approved March 3, 1881, directed the survey of this harbor, and the results, with a project of improvement and estimates of cost, were reported December 28, 1881.

It was proposed to apply the appropriation of $15,000, passed August 2, 1882, to the removal of a portion of Sunken Rock, but it seems to be the desire of the business men of Port Chester to apply the money to dredging the channel of Byram River, leading to the town, this work to take the precedence of the removal of the rock.

In its original condition the channel was obstructed by Sunken and Salt rocks, the former with a depth over it of 5.7 feet at mean low water, the latter projecting above the level of mean low water.

The originally adopted project for the improvement was the removal of these rocks and the construction of a breakwater.

The amount expended to the close of the fiscal year ending June

30, 1882, was $10,050, and the condition of the improvement was the removal of Salt Rock to a depth of 9 feet at mean low water.

The amount expended during the year ending June 30, 1883, was $25.

The estimated amount required for the completion of the improvement of the harbor according to the adopted and approved plan is $69,632.

The commerce of this place is about the same as reported in my last annual report.

Collection district, New York; nearest port of entry, New York; nearest lighthouse, Great Captain's Island.

Amount of revenue collected year ending June 30, 1883, $147,901,488.93. Amount of commerce to be benefited by the completion of this work, ——.

ORIGINAL ESTIMATE.

Removing rocks and building breakwater	$96,632

AMOUNTS APPROPRIATED.

By act approved June 10, 1872	12,000
By act passed August 2, 1882	15,000
	27,000
Amount expended	10,075

Money statement.

July 1, 1882, amount available	$1,950 00
Amount appropriated by act passed August 2, 1882	15,000 00
	16,950 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	25 00
July 1, 1883, amount available	16,925 00
Amount (estimated) required for completion of existing project	69,632 00

E 10.

IMPROVEMENT OF RARITAN RIVER, NEW JERSEY.

The survey of this work was directed by the act approved March 3, 1873, the results of which, with a project for improvement and estimates of cost, were reported February 21, 1874.

Operations with the small drilling scow upon the rocky shoal at Whitehead's Sand-dock have been continued during the year, with the exception of the time when the scow was laid up in winter quarters, from November 30, 1882, to April 3, 1883. Dredging the broken rock was continued from the beginning of the year until January 30, 1883.

The following amount of work was done:

Number of surface blasts	47
Number of holes drilled, average 5 feet deep	132
Number of pounds of giant powder No. 2 Ex. used	1,600
Cubic yards rock removed by drilling scow	4,397
Cubic yards rock removed by dredge	5,745
Cubic yards clay removed by dredge	2,919
Cubic yards shale removed by dredge	1,074
Cubic yards sand and gravel removed by dredge	1,217

The broken stone, &c., has been placed upon the west bank of the river, with the exception of that taken up in May, and which was used for filling Dikes B and C in the South River improvement.

There is now a completed channel at this place 1,000 feet long, 134 feet wide, and 12 feet deep at mean low water.

Under the allotment of $10,000 in the act passed August 2, 1882, contract was made October 9, 1882, with James D. Leary, to dredge a cut

in the south channel between Crab Island and Kearney's Dock 100 feet wide and 5½ feet deep at mean low water.

The contractor commenced work in October, 1882, but had to suspend operations in December, on account of the ice, until March, when the work was resumed and continued steadily until June 30, when the contract was completed, removing 46,740 cubic yards of material at 13 cents per cubic yard, making a cut 2,520 feet long, 100 feet wide, and 5½ feet deep at mean low water.

The original condition of the navigation was an intricate channel at the Stakes of 7 feet at mean low water, and of 6.1 feet on the Middle Ground, and of 7 to 8 feet at mean low water upon the other shoals as far up as New Brunswick.

The originally adopted project was to dike and dredge at the Stakes and Middle Ground, and to remove other shoals up to New Brunswick, so as to make a channel 200 feet wide and 10 feet at least depth at mean low water, and no modification has been made.

The amount expended to the close of the fiscal year ending June 30, 1882, was $353,196.01.

The condition of the improvement at that time was the completion of the dikes at the Stakes and Middle Ground; a channel at the Stakes everywhere over 12 feet deep at mean low water, except for a short distance, where it has been dredged to but 9 feet at mean low water. Dredging has also been done at the Middle Ground, giving a channel 5,300 feet long, 12 feet deep at mean low water, and of an average width of 130 feet; and a channel has been completed through the rocky shoal at Whitehead's Sand-dock, by drilling and blasting, 1,000 feet long, 75 feet wide, and 12 feet deep at mean low water.

There has been expended during the fiscal year ending June 30, 1883, $39,025.78.

A channel has been completed through the rocky shoal at Whitehead's Sand-dock 1,000 feet long, 134 feet wide, and 12 feet deep at mean low water, and a cut has been dredged through the south channel 2,520 feet long, 100 feet wide, and 5½ feet deep at mean low water.

The balance, $15,979.47, will be expended during the year ending June 30, 1884, in blasting and removing the rocks at Whitehead's Sand-dock and doing some little dredging in the south channel.

The estimated amount required for the entire and permanent completion of the work of improvement in accordance with the approved and adopted project is $1,683,662.05.

This work is in the collection district of Amboy. Nearest port of entry, Perth Amboy. Nearest light-house, Raritan Bay.

Amount of revenue collected for the year ending June 30, 1883, $82,475.15. Amount of commerce to be benefited by the completion of this work, $1,500,000 per annum.

ORIGINAL ESTIMATE.

For a 10-foot channel at mean low water.

Dredging tidal basin, 648,000 cubic yards, at 40 cents	$259,200 00
Shoal, commencing 160 feet below New Brunswick locks, 2,399 cubic yards	78,767 85
Reef of rocks opposite Martin's Dock, 4,672 cubic yards	182,208 00
Rocks 300 feet below New Brunswick locks, 2,399 cubic yards	76,768 00
Ledge of rocks 3,300 feet above Martin's Dock, 17,504 cubic yards	542,624 00
Shoal below Widmar's Dock, 14,400 cubic yards, at 35 cents	5,040 00
Reef of rocks covered with sand, near Whitehead's Dock, 11,509 cubic yards	497,188 80
Middle Ground, 55,555 cubic yards, at 35 cents	19,444 25
Stakes, 15,528 cubic yards, at 35 cents	5,434 80
Dike, 11,400 feet long, at $13.50 per running foot	153,900 00
Contingencies, 15 per cent. of the above	273,086 35
	2,093,662 05

REVISED ESTIMATE.

For excavating a channel 200 *feet wide and* 12 *feet deep at mean low water from* 1,000 *feet above Whitehead's Sand-dock to canal lock at New Brunswick.*

From 1,000 feet above Whitehead's Sand-dock to Lawrence Creek:	
47,000 cubic yards of dredging, at $1	$47,000
From Lawrence Creek to 190 feet above Martin's Dock:	
106,000 cubic yards of dredging, at $1	106,000
From 1,000 feet above Martin's Dock to end of steamboat dock:	
2,600 linear feet of crib dike, at $15	39,000
74,200 cubic yards of rock excavated, at $10	742,000
184,000 cubic yards of dredging, at $1	184,000
From end of steamboat dock to canal lock:	
94,100 cubic yards of rock excavation, at $10	941,000
27,800 cubic yards of dredging, at $1	27,800
Contingencies, engineering, &c	313,020
	2,399,820

For excavating a channel 200 *feet wide and* 10 *feet deep at mean low water from* 1,000 *feet above Whitehead's Sand-dock to the canal lock at New Brunswick.*

From 1,000 feet above Whitehead's Sand-dock to Lawrence Creek:	
21,500 cubic yards of dredging, at $1	$21,500
From Lawrence Creek to 1,000 feet above Martin's Dock:	
45,800 cubic yards of dredging, at $1	45,800
From 1,000 feet above Martin's Dock to end of steamboat dock:	
2,600 linear feet of crib dike, at $15	39,000
4,700 cubic yards rock excavation, at $15	70,500
138,300 cubic yards of dredging, at $1	138,300
From end of steamboat dock to canal lock:	
56,800 cubic yards of rock excavation, at $15	568,000
27,800 cubic yards of dredging, at $1	27,800
Contingencies, engineering, &c	136,635
	1,047,535

AMOUNTS APPROPRIATED.

By act approved June 18, 1878	$200,000 00
By act approved March 3, 1879	60,000 00
By act approved June 14, 1880	100,000 00
By act approved March 3, 1881	25,000 00
By act passed August 2, 1882	25,000 00
	410,000 00
Received from sales of coal	180 00
	410,180 00
Amount expended	392,221 79

Money statement.

July 1, 1882, amount available		$27,792 11
Received from sales of coal to Col. John Newton		90 00
Amount apppropriated by act passed August 2, 1882		25,000 00
		52,882 11
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$34,923 90	
July 1, 1883, outstanding liabilities	1,978 74	
		36,902 64
July 1, 1883, amount available		15,979 47
Amount (estimated) required for completion of existing project		1,683,662 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		60,000 00

Abstract of bids for dredging in South Channel, Raritan River, N. J., opened September 27, 1882.

Bidders.	Price.
	Per cu. yd.
James D. Leary	$0 13
Michael H. Flannery	19½
J. H. Fenner	22
James Caler & Son	35

Contract awarded to James D. Leary; dated October 9, 1882; completed.

COMMERCIAL STATISTICS.

Tabulated statement of tonnage passing through the Delaware and Raritan Canal at New Brunswick, N. J.

	1881.	1882.
	Gross tons.	*Gross tons.*
Products of the forest:		
Lumber	18,298	6,510
Shooks, staves, bark, heading, shingles, hoops, hoop-poles	5,820	3,266
Cord-wood, cross-ties, telegraph poles, and other articles	41,654	57,395
Products of mines, quarries, &c.:		
Coal, anthracite	534,186	447,630
Coal, bituminous and slack	292,461	154,613
Coke	473	.....
Iron ore	92,327	118,115
Stone, lime, and other articles	155,688	117,734
Petroleum	847	388
Products of animals:		
Live stock	300	475
Provisions	2,342	3,877
Butter, eggs, and cheese	786	389
Other articles	16,009	22,349
Agricultural products:		
Flour	13,754	12,187
Wheat	2,569	12,950
Corn	5,269	4,833
Rye	5,195	79
Oats	741	331
Cotton	3,322	3,628
Leaf tobacco	2,523	5,192
Other articles	28,050	24,455
Manufactures:		
Railroad iron	7,073	2,745
Boots, shoes, and hats	150	272
Iron—scrap, pigs, and blooms	29,269	36,446
Iron—manufactured and machinery	48,623	56,978
Beer, whisky, and alcohol	3,659	4,362
Sugar and molasses	62,086	48,967
Oils (other than petroleum)	4,456	4,384
Dry goods	3,223	3,707
Other manufactures	104,458	74,523
Merchandise	20,998	29,180
Miscellaneous	20,716	22,172
Military stores, United States Government	124	.....
Military stores, State of New Jersey	130	.....
Total gross tons	1,527,579	1,280,141

There also passed through outlet lock into free level (New Brunswick City front), during the year of 1882, 255 boats, 104 schooners, 308 sloops, 936 steamers, with a tonnage of 12,619 gross tons.

Vessels entered and cleared at the port of Perth Amboy, N. J., from June 30, 1880, *to June* 30, 1883.

VESSELS ENTERED.

Years.	Coastwise.		American.		Foreign.		Total.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
1880	134	26, 693. 00	17	4,677	15	5, 725	166	37, 095. 00
1881	72	15, 211. 00	4	2, 199	14	17, 125	90	34, 535. 00
1882	103	20, 594. 00	2	685	15	13, 478	120	34, 712. 00
1883	159	38, 619. 34	.....	.....	18	22, 094	177	60, 713. 34

VESSELS CLEARED.

1880	53	16, 504. 00	9	2, 880	22	3, 938	84	23, 322. 00
1881	58	28, 136. 00	19	7, 746	27	7, 927	104	43, 809. 00
1882	41	18, 263. 00	12	4, 386	29	7, 189	82	29, 838. 00
1883	65	22, 618. 00	34	13, 646	25	8, 110	124	44, 374. 00

Value of exports, imports, duties collected and accrued at port of Perth Amboy, N. J.

Years.	Exports.	Imports for consumption.	Imports for warehouse.	Total.	Duties collected.	Duties accrued.	Total.
1880	$31, 158	$61, 076 77	.....	$61, 076 77	$15, 466 25	.....	$15, 466 25
1881	84, 126	111, 298 00	$81, 109 00	192, 408 00	37, 456 74	$44, 732 25	82, 188 99
1882	42, 179	77, 883 00	106, 751 39	226, 813 39	75, 715 50	8, 258 34	83, 973 84
1883	94, 780	109, 352 00	77, 634 00	186, 986 00	82, 475 15	.....	82, 475 15

Statement of number and tonnage of vessels belonging to and documented at port of Perth Amboy, N. J.

Years.	Sailing vessels.		Steam vessels.		Barges.		Canal boats.		Total.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
1880	318	16, 848. 87	62	10, 211. 87	61	10, 660. 87	137	14, 784. 30	578	52, 505. 91
1881	326	18, 684. 31	69	11, 208. 06	73	14, 947. 28	138	14, 940. 08	606	59, 779. 73
1882	351	17, 215. 92	73	12, 048. 21	99	20, 174. 95	140	15, 341. 02	663	64, 780. 10
1883	363	17, 489. 19	67	9, 812. 51	95	20, 507. 61	139	15, 218. 72	664	63, 028. 08

E 11.

IMPROVEMENT OF SOUTH RIVER, NEW JERSEY.

The survey of this river was directed by the act approved March 3, 1879, and the results, with a project of improvement and estimates of cost, were reported January 23, 1880.

South River is a tributary of the Raritan, which it enters by two courses, the one natural and the other artificial, $1\frac{1}{4}$ miles below the former.

The original condition of the navigable channel is, first, a false direction of the canal mouth, a depth there at mean low water of $3\frac{1}{2}$ feet; thence up to Little Washington, depth varying from 3.1 to 11.6 feet at mean low water; thence to Bissett's brick-yard, depths varying from 2.8 to 10.1 feet at mean low water, and thence to Old Bridge, depth varying from 2.1 to 12.5 feet at mean low water.

There are also several sharp bends above Little Washington where it will be expedient to straighten the course occasionally by cuts.

The originally adopted project, which has not been modified, was to change the outlet of the canal, to close the natural course of the river below Petit's, to dike and to dredge in order to obtain 8 feet at mean low water up to Little Washington; thence to straighten the course, dike, and dredge up to Bissett's brick-yard, in order to obtain 6 feet at mean low water; and finally to straighten the course, dike, and dredge to Old Bridge, in order to obtain 4 feet at mean low water.

Under date of June 29, 1882, proposals were advertised to be opened on July 20, for constructing dikes and dredging at the entrance of the canal into the Raritan River. The bids received were not satisfactory, and under authority from the Chief of Engineers the work was readvertised under date of September 11, 1882, and on October 9, 1882, contract was made with Henry Du Bois & Sons for removing and rebuilding a portion of the wharf at the entrance to the canal, constructing about 5,800 feet of dike, and to dredge about 6,232 cubic yards of material.

Work was commenced by the contractor in November, 1882, and progressed very favorably. Owing to unexpected difficulties in the way of hard driving for piles and detention by low water, the contract has been extended from June 30, 1883, to October 1, 1883.

The following work has been completed:

Removing and rebuilding a portion of the wharf at the junction of the Raritan River and the South River Canal, Dike A, 352 feet; Dike B, 621 feet; Dike C, 275 feet; Dike D, 1,531 feet.

Under the terms of the contract the contractor was not to fill Dikes A, B, and C with stone, as it was intended to utilize the broken rock taken up by the small drilling scow near Whitehead's Sand-dock in the Raritan River for this purpose.

At the close of the year, 40 feet of Dike B, and 122 feet of Dike C, had been filled in this way.

The amount expended to the close of the year ending June 30, 1882, was $738.63, without change in the condition of the river.

The amount expended during the year ending June 30, 1883, was $23,338.57, with some advantage to commerce near the outlet to the canal, the work not being sufficiently advanced as yet to produce the desired results.

The balance, $3,920.74, will be applied to continuing the filling of Dikes A, B, and C with stone.

The estimated amount for the entire and permanent completion of the work of improvement, in accordance with the approved and accepted project, is $138,695.

The amount of commerce to be benefited annually is represented to be 193,175 tons, of the value of $3,415,300, the principal articles of export being bricks, moulding, sand, and wood, fruits and vegetables.

On South River and tributaries there are represented to be:

Brick-works	10
Flour-mills	11
Licorice-mill	1
Snuff and tobacco manufactories	4
Handkerchief works	1
Saw-mills	6
Ship-yard	1

All the above are in active operation.

This work is in the collection district of Amboy. Nearest port of entry, Perth Amboy. Nearest light-house, Raritan Bay.

Amount of revenue collected during the year ending June 30, 1883, $82,475.15. Amount of commerce to be benefited by the completion of this work, $3,000,000.

ORIGINAL ESTIMATE.

Changing and deepening canal:		
10,000 cubic yards of dredging, at 30 cents	$3,000	
120,000 cubic yards of dredging, at 15 cents	18,000	
900 linear feet of half-dike, at $6	5,400	
1,700 linear feet of dike, at $8	13,600	
180 linear feet of dam, at $10	1,800	
		$41,800
From canal to Washington:		
17,000 cubic yards of dredging, at 15 cents	2,550	
2,300 linear feet of dike, at $8	18,400	
		20,950
Cut-off above Washington:		
6,000 cubic yards of dredging, at 30 cents	1,800	
40,000 cubic yards of dredging, at 15 cents	6,000	
900 linear feet of dike, at $6.50	5,850	
1,400 linear feet of half-dike, at $5	7,000	
		20,650
In front of brick-yards:		
15,000 cubic yards of dredging, at 15 cents	2,250	
1,600 linear feet of dike, at $6.50	10,400	
		12,650
From Cut-off to Bissett's brick-yard:		
40,000 cubic yards of dredging, at 15 cents	6,000	
6,500 linear feet of dike, at $6.50	42,250	
		48,250
Above Bissett's brick-yard:		
2,000 cubic yards of dredging, at 15 cents	300	
700 linear feet of dike, at $6.50	4,550	
		4,850
New Cut-off above Bissett's brick-yard:		
3,000 cubic yards of dredging, at 30 cents	900	
16,000 cubic yards of dredging, at 20 cents	3,200	
600 linear feet of dike, at $6.50	3,900	
900 linear feet of half-dike, at $5	4,500	
		12,500
At mouth of Tennent's Brook:		
2,000 cubic yards of dredging, at 20 cents	400	
500 linear feet of dike, at $6.50	3,250	
		3,650
From Tennent's Brook to Old Bridge:		
20,000 cubic yards of dredging, at 20 cents		4,000
Engineering, contingencies, &c		25,395
		194,695

AMOUNTS APPROPRIATED.

By act approved June 14, 1880	$40,000 00
By act approved March 3, 1881	6,000 00
By act passed August 2, 1882	10,000 00
	56,000 00
Amount received from sales of coal	30 06
	56,030 06
Amount expended	24,007 20

Money statement.

July 1, 1882, amount available		$45,261 37
Received from sales of coal to Col. John Newton		30 06
Amount appropriated by act passed August 2, 1882		10,000 00
		55,291 43
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$23,338 57	
July 1, 1883, outstanding liabilities	28,032 12	
		51,370 69
July 1, 1883, amount available		3,920 74
Amount (estimated) required for completion of existing project		138,695 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		23,000 00

Abstract of bids for dredging, diking, &c., at the mouth of Little Washington Canal, opened September 27, 1882.

Bidders.	Altering dock.	Dike A, not filled.	Dike B, not filled, dredging.	Dike C, not filled.	Dike D, filled.	Dike E, filled.	Dike F, filled.	Total.
Henry Du Bois & Sons	$2,100	$5 44	$7 79	$5 44	$7 24	$7 97	$8 97	$47,137 88
Frank Pidgeon, jr.	2,250	5 60	8 45	5 60	7 49	8 19	9 22	48,892 80
Thomas H. Benton.	3,250	7 00	9 60	5 50	7 50	7 80	9 30	50,732 70
E. L. Richardson...	3,300	5 98	11 64	5 08	7 33	8 06	9 76	52,434 68
Stephen A. Kelly ..	2,400	5 00	11 40	6 00	8 25	8 90	9 85	53,921 30

Contract awarded to Henry Du Bois & Sons; dated October 9, 1882; to be completed June 30, 1883; extended to October 1, 1883.

COMMERCIAL STATISTICS.

The tonnage of vessels engaged in the South River is about 328,850.

ARTICLES SHIPPED AND RECEIVED DURING THE YEAR ENDING JUNE 30, 1883.

Shipped:		
Bricks	number..	50,000,000
Wood	cords..	12,000
Chestnut posts	number..	30,000
Hoop-poles	do...	60,000
Clay and sand	tons..	7,000
Salt hay	do...	3,000
Small fruits	crates..	14,000
Peaches	baskets..	50,000
Apples	barrels..	10,000
General merchandise	tons..	7,000
Received:		
Coal	tons..	10,000
Fertilizers	do...	26,000
General merchandise	do...	2,500

REMOVING SUNKEN VESSELS OBSTRUCTING OR ENDANGERING NAVIGATION.

By the indorsement of the Chief of Engineers of August 3, 1882, on a letter from Mr. Joseph Jenks, of Sing Sing, N. Y., I was directed to report upon the removal of the wreck of a lighter lying nearly opposite the village of Sparta, just below Sing Sing, on the Hudson River, which I did, as follows:

The wreck belongs to the Empire Lighterage Company, 75 South street, New York, and is a lighter of about 250 tons; it is lying upon sandy bottom, nearly opposite the village of Sparta, just below Sing Sing, about half a mile from shore. The wreck was visited at low water; the water was 9 feet deep all around the lighter, which was distant only 150 feet from the 12-foot contour of this channel, and 200 feet from the 18-foot contour. In its present condition it constitutes a dangerous obstruction at night or in a fog.

There is nothing of value in the wreck to pay the expenses of removal. The cost of removal would not be great. A more detailed examination might be necessary before entering into contract for the removal.

The United States has on hand all the appliances for the work.

By letter of September 5, 1882, from the Chief of Engineers, I was notified that the honorable the Secretary of War had approved the rec-

ommendation to remove the wreck in accordance with the provisions of section 4 of the river and harbor act of June 14, 1880, and of the act passed August 2, 1882.

Acting under these instructions, the following communication was sent to the owners of the lighter:

NEW YORK, *October* 3, 1882.

To the Empire Lightering Company, 75 South street:

GENTLEMEN: Understanding you are the owners of a lighter which was sunk near Sing Sing, in the Hudson River, I have, by direction of the Secretary of War and under the provisions of the law of Congress, to give notice to those concerned that if the owners do not remove the said wreck or institute measures for its removal within thirty days after the receipt of this notice, it will be treated as abandoned and derelict, and will be removed by the Government. The vessel and cargo, when so removed, if of any value, will be sold, and the proceeds will be deposited in the Treasury of the United States.

I append a copy of the law of Congress pertaining to this matter.

Not hearing anything from the owners of the lighter at the expiration of the thirty days, inquiry was made, and they said they had abandoned the wreck. The work was then advertised and contract made with Edward R. Lowe for the removal of the lighter for the sum of $1,125.

In consequence of the early formation of ice along the shore of the river the contractor was not able to commence work until in the spring, and as soon as the ice had left the river he put his pontons over the wreck, and after removing the stone ballast and loose portions of the vessel he passed chains under the hull, raised it with the tide, and then towed it down to Gowanus Bay and placed it above high-water mark on the shore.

The total cost of the removal of the wreck was $1,201.15, and was paid for from the appropriation for "removing sunken vessels or crafts obstructing or endangering navigation."

Abstract of bids for the removal of the wreck of a lighter now lying on the flats near Sing Sing, on the Hudson River, New York, opened December 13, 1882.

Bidders.	Price.
E. R. Lowe	$1,125
Isaac E. Chapman and John C. Gibbs	1,193

Contract awarded to E. R. Lowe; dated December 21, 1882; completed.

APPENDIX F.

IMPROVEMENT OF RIVERS AND HARBORS ON WESTERN LONG ISLAND, IN THE VICINITY OF NEW YORK CITY, AND IN NORTHERN NEW JERSEY.

REPORT OF MAJOR GEORGE L. GILLESPIE, CORPS OF ENGINEERS, BVT. LIEUT. COL., U. S. A., OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1883, *WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

1. Flushing Bay, New York.
2. Newtown Creek, New York.
3. East Chester Creek, New York.
4. Canarsie Bay, New York.
5. Sheepshead Bay, New York.
6. Sumpawanus Inlet, New York.
7. Cheesequakes Creek, New Jersey.
8. Passaic River above Newark, New Jersey.
9. Passaic River from Pennsylvania Railroad bridge to its mouth, New Jersey.
10. Channel between Staten Island and New Jersey.
11. Shrewsbury River, New Jersey.
12. Rahway River, New Jersey.
13. Elizabeth River, New Jersey.
14. Woodbridge Creek, New Jersey.
15. Manasquan River, New Jersey.
16. Raritan Bay, New Jersey.
17. Mattawan Creek, New Jersey.
18. Keyport Harbor, New Jersey.
19. Removal of sunken vessels obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
New York, July 27, 1883.

GENERAL: I have the honor to transmit herewith the annual reports for the fiscal year ending June 30, 1883, for the works of improvement of rivers and harbors and of surveys which have been in my charge.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Major of Engineers,
Bvt. Lieut. Col., U. S. A.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

F 1.

IMPROVEMENT OF FLUSHING BAY, NEW YORK.

The charge of this improvement was transferred from Col. John Newton, Corps of Engineers, to myself by Department letter of June 26, 1882.

The project for this improvement was adopted in 1879, and has for its object the formation of a tidal basin, by means of dikes, which, by its filling and emptying through one channel, would maintain a depth of 6 feet at mean low water, after that depth had been once obtained by dredging.

The amount available during the fiscal year ending June 30, 1883, was $7,255.71. Sealed proposals, invited by public advertisement, were

opened September 22, 1882, and the contract for dredging was awarded to Henry N. and Alonzo J. Beardsley, the lowest responsible bidders, at 19½ cents.

Dredging operations under the contract were commenced on the 22d of November, and were completed January 6, 1883, the total amount of material removed being 31,959 cubic yards.

A channel 1,900 feet long, 80 feet wide, and 6 feet deep, mean low-water, was opened from near the outer end of the dike to the deep water of the exterior bay, and a branch channel 1,500 feet long, 80 feet wide, and 6 feet deep was made from Hill's Dock, on the west side, to a connection with the Flushing Channel, around the inner end of the dike. The range of tides being 7 feet, approximately, the improved channel can now be used, at high-tide, by vessels drawing 12 feet. About 600 sailing vessels do business in the harbor, some of them drawing 10 to 11 feet of water. Two steamboats run regularly from New York to Flushing, and the tonnage carried during the year is estimated at —— tons.

The amount of commerce to be benefited by this improvement is estimated at $5,000,000 annually. It is essential to the maintenance of the channel now open that the dike should be extended 2,700 feet outwards to the 6-foot curve included in the original plan, and that the channel should be given a least width throughout of 100 feet. The appropriation of $40,000 asked for will be applied in making these improvements.

Flushing Bay is in the collection district of New York, which is the nearest port of entry. Nearest light-house, North Brother Island. Nearest fort is Fort Schuyler, New York Harbor.

Amount of revenue collected during the past fiscal year, $147,901,488.93. Amount of commerce to be benefited by this improvement, $5,000,000 annually.

Original estimate for dikes and dredging	$173,500 00
Amount appropriated, act March 3, 1879, to act August 2, 1882, both inclusive	50,000 00
Amount expended, exclusive of outstanding liabilities	49,991 37

Money statement.

July 1, 1882, amount available	$2,255 71	
Amount appropriated by act passed August 2, 1882	5,000 00	
		7,255 71
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	7,247 08	
July 1, 1883, amount available		8 63
Amount (estimated) required for completion of existing project		123,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		40,000 00

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Abstract of proposals for improving Flushing Bay, New York, opened September 22, 1882, by Maj. George L. Gillespie, Corps of Engineers.

No.	Names of bidders.	Price.	Date of commencement.	Date of completion.
		Per cu.yd.		
1	Henry N. & Alonzo J. Beardsley	$0 19½	Oct. 1, 1882	Omitted.
2	Frank Pidgeon, jr	29	Omitted.....	Do.

Contract awarded to Henry N. & Alonzo J. Beardsley, the lowest responsible bidders, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

The following statement relative to the commerce of Flushing Bay was furnished by Mr. H. Hill and other residents of Flushing, L. I.:

IMPORTS.

Coal	tons..	23,724
Bricks	number..	606,200
Manure	tons..	52,000
Lumber	feet..	3,052,093
Laths		420,800
Shingles		90,200
Nails	pounds..	44,000
Cement	barrels..	2,738
Plaster	do...	175
Flagging	square feet..	8,000
Broken bluestone	tons..	1,000
Dye wood	do...	1,500

EXPORTS.

Manufactured goods	tons..	600
Iron castings	do...	1,000
Tallow	do...	600
Dye-wood	do...	2,500
Portable houses		150
Building-sand	cubic yards..	280,000

One steamboat carrying general merchandise and passengers makes daily trips between Flushing, College Point, and New York. Three steam-tugs are employed in towing vessels in and out of the bay and creek. Sixteen schooners and sloops and ten barges are engaged in carrying sand, and five schooners and sloops in transporting manure.

F 2.

IMPROVEMENT OF NEWTOWN CREEK, NEW YORK.

The charge of this improvement was transferred from Col. John Newton, Corps of Engineers, to myself by Department letter of June 26, 1882.

The original approved project for the improvement was to dredge a channel 200 feet wide with 18 to 21 feet at mean low water from the entrance to Vernon Avenue Bridge. Before the improvement was begun the depth varied from 12½ to 18 feet mean low water, the width of channel being 240 feet approximately.

The improvement at the close of the fiscal year ending June 30, 1882, consisted of a channel dredged to a width of 60 feet, with a depth of 15 to 17 feet mean low water.

The amount available during the fiscal year ending June 30, 1883, for continuing the improvement was $16,147.11. Sealed proposals, invited by public advertisement, were opened in this office September 22, 1882, and the contract for dredging awarded to Messrs. Henry N. & Alonzo J. Beardsley, the lowest responsible bidders, at 27 cents per cubic yard.

The contract was closed June 27, 1883, after the removal of 52,005 cubic yards of mud and sand, including a few large bowlders found near the bridge. Under the contract the channel westward for a distance of 1,100 feet from the south draw opening was deepened to 18 feet at mean low water over a width of 75 feet, and thence 1,200 feet to the entrance the width was increased to 150 feet. The oil-pipe of the Devol Manufactur.

ing Company crosses the creek near the Vernon Avenue Bridge, and is sunk at a depth of about 18 feet below mean low water.

The company has been requested to take this pipe up and set it at a level below 21 feet below mean low water, so as not to obstruct the channel when the project of improvement shall be completed.

The commerce which enters the creek is exceedingly large, and is daily increasing. Oil refineries and manufacturing interests of almost every class are located upon both banks, from the mouth to Metropolitan avenue, a distance of 4 miles, the estimated value of which exceeds $20,000,000. At Metropolitan avenue the depth is 6 feet at mean low water. The many valuable interests along this great avenue of commerce demand that this depth should be increased to 10 feet.

The river and harbor act of August 2, 1882, provided for a survey of this creek to the head of navigation, and I would recommend that the project for the extended improvement form part of that already adopted for the reach below Vernon Avenue Bridge.

The improvement required for the upper portion will consist mainly of dredging, and the material to be removed, as far as can be ascertained, consists of thick mud and heavy refuse from the refineries. A channel 100 feet wide with 10 feet depth at mean low water would advance the commercial interests of the community in a high degree.

It will require the removal of 220,000 cubic yards approximately of material measured in place—based on the results of the preliminary examination—at a cost of about $75,000. To maintain the dredged channel it is probable that a system of diking will also be required, for which no estimate can be given until after the survey has been completed.

Of the appropriation of $75,000 asked for, $21,000 will be applied at the entrance, and the residue in the upper section of the river.

The wharves of this creek form, in reality, an extension of the wharves of New York City and Brooklyn, and any increase to the shipping facilities of the stream serves to enlarge the commercial importance of all.

This work is in the collection district of New York. Nearest light-house is on Blackwell's Island, and the nearest fort is Fort Columbus, Governor's Island, New York Harbor.

Amount of revenue collected during the past fiscal year, $147,901,488.93; amount of commerce to be benefited by the completion of this work, $20,000,000.

Original estimate (revised)	$100,000 00
Amount appropriated from act June 14, 1880, to act August 2, 1882, both inclusive	25,000 00
Amount expended, exclusive of outstanding liabilities	24,053 13

Money statement.

July 1, 1882, amount available	$1,147 11
Amount appropriated by act passed August 2, 1882	15,000 00
	16,147 11
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	15,200 24
July 1, 1883, amount available	946 87
Amount (estimated) required for completion of existing project	75,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	75,000 00

Abstract of proposals for improving Newtown Creek, New York, opened September 22, 1882, by Maj. George L. Gillespie, Corps of Engineers.

No.	Names of bidders.	Price.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	Henry N. & Alonzo J. Beardsley	$0 27	Jan. 1, 1883	April 1, 1883.
2	John W. & David Ambrose and Robert J. Mills	29	Omitted	Omitted.
3	Chandler H. Loomis	40	do	Fifty days from commencement of work.

Contract awarded to Messrs. Henry N. & Alonzo J. Beardsley, the lowest responsible bidders, with the approval of the Chief of Engineers.

F 3.

IMPROVEMENT OF EAST CHESTER CREEK, NEW YORK.

The charge of this improvement was transferred from Col. John Newton, Corps of Engineers, to myself by Department letter of June 26, 1882.

The project for this improvement was adopted in 1872, and provides for the making of a channel, with 9 feet at high water, from Town Dock to a point 3,000 feet above Lockwood's, including the construction of a tidal basin above Lockwood's.

This project has since been extended by dredging a channel west of Goose Island in the lower river to afford 9 feet at high water around the island, and by the removal of bowlders and gravel just below Pelham Bridge. The original estimate for the project was $136,500. Previous to improvement the ruling depth between Town Dock and Lockwood's was less than 7 feet at mean high water, and the channel narrow and crooked. The depth has been increased to 9 feet, and the channel straightened, so as to reduce the distance between these from 5,500 feet to 3,200 feet.

Nothing has been done towards the formation of the tidal basin above Lockwood's, owing to insufficiency of funds. The report of 1872 refers to a system of diking probably necessary below Town Dock, but no detailed estimate is given for its construction. No vessels have gone, during the year, to the old wharves at Lockwood's, and it seems unnecessary, at the present time, to apply any of the money on hand in the upper river.

The two towns of East Chester and Mount Vernon have had some dispute lately relative to the propriety of the latter town leading its sewer pipes into the creek above Town Dock, and the question has been brought before the State legislature for legislative enactment.

No work of improvement was done. The amount available for continuing the improvement will be applied in dredging a channel 50 feet wide and 1,500 feet long, affording 9 feet at high water from Town Dock downstream to near Pell Point, and in removing a few dangerous bowlders from the channel near Goose Island.

The appropriation of $30,000 asked for will be applied in extending the 9-foot channel from Town Dock to Lockwood's, and in the construction of lateral dikes of sheet-piling below Town Dock for the purpose of maintaining the channel soon to be improved by dredging, enabling vessels drawing not to exceed 9 feet to reach Lockwood's from the entrance at

mean high water. . The aggregate length of the projected dikes is 5,800 feet, at an estimated cost of $64,000, the timber to be creosoted.

The amount necessary for the entire and permanent completion of the work of improvement in accordance with approved project is $82,500.

It is recommended that 25,000 cubic yards of material be dredged and 2,500 feet of diking be built in continuance of the improvement for the fiscal year ending June 30, 1885.

This work is in the collection district of New York. Nearest port of entry, New York. Nearest light-house, Stepping Stones. Fort Schuyler is the nearest fort.

Amount of revenue collected during fiscal year ending June 30, 1883, $147,901,488.93.

Amount of commerce benefited by the completion of this work, unknown.

Original estimate	$136,500 00
Amount appropriated from March 3, 1873, to June 14, 1880, both inclusive.	54,000 00
Amount expended, exclusive of outstanding liabilities	46,918 20

Money statement.

July 1, 1882, amount available	$7,101 80
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	20 00
July 1, 1883, amount available	7,081 80
Amount (estimated) required for completion of existing project	82,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	30,000 00

F 4.

IMPROVEMENT OF CANARSIE BAY, NEW YORK.

The charge of this improvement was transferred from Col. John Newton, Corps of Engineers, to myself by Department letter of June 26, 1882.

The object of this improvement is to connect Canarsie Landing with the deep water of Jamaica Bay by channel having a depth of 6 feet at mean low water, the original depth across the flats being only 4½ feet. The project for the improvement which contemplated the formation of a tidal basin, by a system of dikes, was adopted in 1879, at an estimated cost of $88,000.

The north dike, 1,000 feet long, was built in 1881, under act June 14, 1880, appropriating $10,000, and act of March 3, 1881, appropriating $5.000.

The amount available July 1, 1882, was $5,220.71. By act of August 2, 1882, appropriating $3,000, the amount available for the fiscal year ending June 30, 1883, became $8,220.71; this was applied wholly in dredging, as the amount was too small to justify any dike construction. Sealed proposals, invited by public advertisement, were opened September 22, 1882, and the contract awarded to Elijah Brainard, the lowest responsible bidder, at 48 cents per cubic yard. Owing to the lateness of the season and the great call for dredging, the contract was not commenced until February 8, 1883; on the 31st of March the contract was closed, the contractor having removed under his contract 9,726 cubic yards of mud and sand between the east end of the north side and Canarsie Wharf. The dike, which was injured during the winter of 1881–'82, was repaired by sinking a crib 15 feet square, ballasted with stone, on the east end. The channel, 6 feet deep at mean low water, is

now 50 feet wide at the outer reach at the dike, and 75 feet wide where it approaches the landing; and narrow cuts have been made at the wharf so that vessels may lie on the east and north sides.

The improvement gives great satisfaction to the great number of fishing vessels which bring their fish to the landing for transportation to New York City, but it is very probable that the channel cannot be maintained at the improved depth until after the construction of the sheet-pile dike on the south side, embodied in the original project.

This harbor is especially noted for its fishing, which is a very important industry. Several hundred vessels are constantly employed during the fishing season, and it is estimated that the annual yield of fishing amounts to about 500,000 bushels of oysters, 10,000 bushels of clams, and 300,000 pounds of fish of different kinds.

In summer a steamboat runs to Rockaway, and a boat to Barren Island all the year round.

This work is in the collection district of New York. Nearest port of entry, New York City. Nearest light-house is Fort Tompkins light, and the nearest fort, Fort Hamilton, New York Harbor.

Amount of revenue collected at the port of New York during the fiscal year ending June 30, 1883, $147,901,488.93.

Original estimate	$88,000
Amount expended to date	18,000
Amount appropriated from act June 14, 1880, to act August 2, 1882, both inclusive	18,000

Money statement.

July 1, 1882, amount available	$5,220	71
Amount appropriated by act passed August 2, 1882	3,000	00
	8,220	71
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	8,220	71
Amount (estimated) required for completion of existing project	70,000	00
Amount that can be profitably expended in fiscal year ending June 30, 1885	20,000	00

Abstract of proposals for improving Canarsie Bay, New York, opened September 22, 1882 by Maj. George L. Gillespie, Corps of Engineers.

No.	Names of bidders.	Price.	Date of commencement.	Date of completion.
		Per cubic yard.		
1	Henry N. & Alonzo J. Beardsley	$0 50 at sea; $0 40 at bay.	April 1, 1883	July 1, 1883
2	John McDermott	67	Omitted	Aug. 30, 1883
3	Elijah Brainard	48	Feb. 1, 1883	April 1, 1883

Contract was awarded to Mr. Elijah Brainard, the lowest responsibe bidder, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

I am indebted to Wm. Warner, esq., superintendent of the Brooklyn and Rockaway Railroad Company, for the following information relative to the commerce of the bay.

* * * * * *

There are engaged here seventy-five yachts in fishing and oyster business, twelve large sloops and schooners, coal, manure, &c., five hundred to six hundred row-boats

and small sailing craft. There are two steamboats—the Hazel Kirke, running to Rockaway Beach, makes twelve hundred trips per season and carries about 30,000 passengers; the Edith Peck, running to Barren Island, makes about one thousand trips per annum and carries, say, 5,000 passengers.

The value of the above sail and steam craft is estimated at $100,000. The hotel property is worth at least $50,000. There are sold from the bay annually about 500,000 bushels of oysters; 10,000 bushels of clams; codfish, $5,000 worth; bluefish, $10,000 worth. About 5,000 tons of coal comes into the port and, say, $2,000 worth of manure.

F 5.

IMPROVEMENT OF SHEEPSHEAD BAY, NEW YORK.

The charge of this improvement was transferred from Col. John Newton, Corps of Engineers, to myself by Department letter of June 26, 1882.

The project for this improvement was adopted in 1879, and provided for deepening the entrance by means of converging jetties and for improving the interior channel by longitudinal dikes, so placed as in some instances to form tidal reservoirs for the scour of the channel. The project was revised in 1881, so as to provide, under certain contingencies, for the opening of a cut to connect the bay with Dead Horse Inlet, 1,650 feet long and 100 feet wide, affording 6 feet mean low water; for revetting the banks of the cut, and for dredging the interior channel to the extent of 40,000 cubic yards, the estimate of cost being $34,200. The amount for the entire and permanent completion of the work of improvement in accordance with the approved project remaines at $89,000.

The amount available July 1, 1882, was too small to commence operations of a useful character, and the money was allowed to remain in the Treasury until a further appropriation was made. The river and harbor act, August 2, 1882, appropriated $3,000 for the improvement, making the amount then available $10,316.18, less engineering and office expenses. Sealed proposals, invited by public advertisement, were opened in this office September 22, 1882, for opening the cut to connect the bay with Dead Horse Inlet; and the contract was awarded to Henry N. & Alonzo J. Beardsley, at 45 cents per cubic yard for dredging. The cut being 1,700 feet, approximately, long, it was not possible at the price bid to excavate a channel with a greater width than 38 feet, with the projected depth of 6 feet; a channel of this width is of difficult dredging in such a locality, owing to want of proper depth for floating the scows, unless the material of the first cut were turned over upon the adjacent bank, subject to partial return into the cut through tidal action. Then again, the material being of sand, the slopes would cave rapidly and tend to fill up the cut. Before a decision had been arrived at as to the proper course to pursue for opening so narrow a channel, which should be self sustaining, the property owners interested along the bay communicated with this office several times in an endeavor to have the Government co-operate with them in the improvement of the Inner Bay. No arrangements were made, as the terms could not be agreed upon with the contractor. The season was so late when the contractor's plant became available that no work could be started before winter set in.

In the spring the property owners again opened the conference about the interior bay, alleging that the existing outlet had not materially

changed, and that an increased depth was needed more on the inside than at the outlet, especially as the funds for dredging could cover so slight an extent of improvement. The projected cut being through unstable sand, and the old outlet being not very obstructive to the small craft visiting the bay, the suggestions of the property holders have been received with favor, and it is probable that the Department will be asked to authorize that the funds available be expended on the inside.

The advance westward of the shore end of the west breakers of Rockaway Inlet is progressive, and will surely close the existing outlet in a short time, making the connection with Dead Horse Inlet a necessity. To maintain the improvement of the bay, therefore, the connecting cut with Dead Horse Inlet should be opened.

It will require the excavation of 50,000 cubic yards of material at an estimated cost of 50 cents per cubic yard, and the construction of 1,200 feet of revetment at $6 per foot, making the cost of improvement at the outlet $35,200.

An appropriation of $35,000 is asked for. This bay has no great commercial importance, and is principally used by very small fishing craft, and the sailing yachts of the property owners on the banks. It is a narrow bay, whose proximity to New York City and Brooklyn makes it a pleasure resort for those persons whose means enable them to build cottages upon its banks, or to occupy summer quarters at the many hotels in the vicinity.

This work is in the collection district of New York. Nearest port of entry, New York City; nearest light-house, Fort Tompkins light; and nearest fort, Fort Hamilton, New York Harbor.

Amount of revenue collected during the fiscal year ending June 30, 1883, was $147,901,488.93.

Original estimate: for dikes of creosoted timber	$100,000 00
Amount expended, exclusive of outstanding liabilities	715 90
Amount appropriated from June 14, 1880, to August 2, 1882, both inclusive.	11,000 00

The amount of commerce to be benefited by this improvement is insignificant.

Money statement.

July 1, 1882, amount available	$7,356 18
Amount appropriated by act passed August 2, 1882	3,000 00
	10,356 18
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	72 08
July 1, 1883, amount available	10,284 10
Amount (estimated) required for completion of existing project	89,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	35,000 00

Abstract of proposals for improving Sheepshead Bay, New York, opened September 22, 1882 by Maj. George L. Gillespie, Corps of Engineers.

No.	Names of bidders.	Price.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	Henry N. & Alonzo J. Beardsley	$0 45	July 1, 1883	Oct. 1, 1883
2	John McDermott	67	Omitted	Aug. 30, 1883
3	Frank Pidgeon, jr	53	do	Omitted.
4	Elijah Brainard	73	April 1, 1883	June 30, 1883

Contract awarded to Henry N. & Alonzo J. Beardsley, the lowest responsible bidders, with approval of Chief of Engineers.

F 6.

IMPROVEMENT OF SUMPAWANUS INLET, NEW YORK.

This improvement was placed under my charge June 26, 1882. The project for the improvement was adopted in 1880, and has for its object to open a channel 100 to 150 feet wide and 5 feet deep at mean low water, from the 5-foot curve of the bay to the town of Babylon. The amount available July 1, 1882, was $4,968; act of August 2, 1882, appropriated $2,000, making the total available during the fiscal year $6,968; this was expended wholly in dredging. Sealed proposals invited by public advertisement were opened September 22, 1882, and the contract awarded to John McDermott, the lowest responsible bidder, at 69 cents per cubic yard. The contract was begun April 9, 1883, and was closed May 17, 1883, after the removal of 9,481 cubic yards of material.

Commencing at the 5-foot curve, 750 feet southeast of the outer end of railroad wharf, a channel 1,000 feet long and 75 feet wide was made towards the inside, directly east of the wharf, giving 5 feet of water at mean low-tide, and single cuts 25 feet wide were made on north, east, and west sides of wharf, enabling vessels to approach and lie alongside the wharf at all stages of the tide.

The improvement as far as it has advanced gives great satisfaction, but the channel should be opened 1,500 feet farther, so that the smaller vessels may take refuge in the inner harbor during easterly gales. The original estimate calls for 67,000 cubic yards of dredging at a cost of 30 cents per cubic yard. The small amount of the appropriation during the year has proportionately increased the cost of removal. It is probable that the future cost will at no time be less than 50 cents per cubic yard, making the total cost of improvement $40,000 instead of $23,115.

Babylon is a wealthy town with a population of 5,000. Capital invested, $3,000,000; 200,000 tons of merchandise are transported annually to the station by the railroad. About two hundred vessels, engaged in fishing in Great South Bay, make this inlet their harbor. It is considered the best point from which to reach all resorts on Great South Bay; the steamer Surf alone carried last year 20,000 passengers to Fire Island. The amount of commerce to be benefited by the improvement is estimated at $500,000 to $750,000 annually.

Original estimate (revised)	$40,000 00
Amount expended to date	6,893 07
Amount appropriated from act March 3, 1881, to act August 2, 1882, both inclusive	7,000 00

Money statement.

July 1, 1882, amount available		$4,968 00
Amount appropriated by act passed August 2, 1882		2,000 00
		6,968 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		6,861 07
July 1, 1883, amount available		106 93
Amount (estimated) required for completion of existing project		33,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		15,000 00

Abstract of proposals for improving Sumpawanus Inlet, New York, opened September 22, 1882, by Maj. George L. Gillespie, Corps of Engineers.

No.	Names of bidders.	Price.	Date of commencement.	Date of completion.
		Per cubic yard.		
1	Henry N. & Alonzo J. Beardsley.....	$1.40 if towed away; $1.25 if dumped in bay.	Omitted	Omitted.
2	John McDermott	69	... do	Aug. 30,1883
3	Elijah Brainard.....	84	June 30, 1883	Sept. 1, 1883

Contract awarded to Mr. John McDermott, the lowest responsible bidder, with the approval of the Chief of Engineers.

F 7.

IMPROVEMENT OF CHEESEQUAKES CREEK, NEW JERSEY.

The charge of this improvement was transferred from Col. John Newton, Corps of Engineers, to myself by Department letter of June 26, 1882.

The project for this improvement, adopted in 1879, provides for changing the outlet into a direction at right angles to the beach; in sustaining the direction by parallel jetties of stone, 200 feet apart, and in straightening the course of the creek and increasing the depth in its upper portions. The appropriations made for this improvement have all been applied at the entrance. The balance available July 1, 1882, was $24,292.11; the river and harbor act of August 2, 1882, appropriated $15,000, making the total available during the fiscal year $39,292.11.

Sealed proposals invited by public advertisement were opened in this office September 22, 1882, and the contract awarded to Samuel R. Cumming, the lowest bidder, at 25½ cents per cubic yard for dredging; $2.55 per cubic yard for stone; $2.30 per square yard for timber platforms, and $4.41 per linear foot for sheet pile revetment.

The contract calls for the excavation of a channel 200 feet wide, 1,600 feet long, with 5 feet at mean low water, connecting the 5 foot inside and outside curves; the protection of the dredged channel by rubble-stone jetties, and for the construction of a sheet pile revetment 450 feet long, rising to mean high water, to close the outlet above the county road bridge.

Operations under the contract commenced in October, and have progressed satisfactorily to date. The two stone jetties have been built according to specifications, each for a distance of 1,000 feet from the beach, and a channel 65 feet wide on bottom has been excavated across the beach and carried 85 to 100 feet wide on top to a point 450 feet from the beach, or 550 feet within the outer end of the jetties.

The jetties contain 3,200 cubic yards of stone and the amount of material excavated in opening the channel was 23,893 cubic yards.

The freeholders for Middlesex County were notified before the improvement began that a bridge would be needed across the new channel, and arrangements have been made by them for supplying one with an adequate draw for commerce.

The amount required, according to original estimate for the entire and permanent completion of the approved project, is $35,279, but by

the prices actually paid for material and labor, under contract, and in excess of those contained in the original estimate, that estimate is proportionately too small The depth of water at the outer end of the jetties is 2 feet 6 inches, mean low water, to reach the 5-foot curve of the bay will require an extension of each jetty a distance of 500 feet.

The appropriation of $20,000 asked for will be applied in extending the jetties to the 5-foot curve and in extending the improved channel by dredging to the same curve.

The commerce of the river is restricted to imports consisting of general merchandise, lime, poudrette and compost, and exports of fire clay, potter's clay, molding sand, bricks, small quantity of iron ore, and cordwood. It is carried in vessels of small class drawing 5 to 7 feet.

It is probable that the completion of this improvement will stimulate trade beyond the proportions it has had in past years. The value of the commerce during the fiscal year is estimated at $110,000.

Amount appropriated from June 14, 1880, to August 2, 1882, both inclusive, $40,000.

This work is in the collection district of Amboy, N. J.; nearest port of entry, Perth Amboy, N. J.; nearest light-house, Prince's Bay; nearest fort is fort at Sandy Hook.

Amount of revenue collected during fiscal year, ———. Amount of commerce to be benefited by this improvement is about $110,000.

Original estimate	$75,279 00
Amount expended to date, exclusive of outstanding liabilities	21,956 13

Money statement.

July 1, 1882, amount available		$24,292 11
Amount appropriated by act passed August 2, 1882		15,000 00
		39,292 11
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$21,248 24	
July 1, 1883, outstanding liabilities	6,578 46	
		27,826 70
July 1, 1883, amount available		11,465 41
Amount (estimated) required for completion of existing project		35,279 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		20,000 00

Abstract of proposals for improving Cheesequakes Creek, New Jersey, opened September 22, 1882, by Maj. George L. Gillespie, Corps of Engineers.

No.	Names of bidders.	Price for dredging.	Price for stone in jetties.	Price for timber platform foundation.	Price for sheet pile revetment.	Date of commencement.	Date of completion.
		Pr. cu. yd.	*Pr. cu. yd.*	*Per sq. yd.*	*Per linear foot.*		
1	John M. Weldon ..	$0 49	$4 50	$2 60	$8 double; $6 single.	Omitted	Dec. 1, 1883
2	Henry DuBois & Sons.	50	1 85	1 80	$6.07 for 250 feet, $7.17 for 200 feet, with anchor piles.	....do	Omitted.
3	Samuel R. Cumming.	25½	2 55	2 30	$4 41	....do	May 1, 1883
4	Frank Pidgeon, jr	53	1 50	1 89	5 95	do	Omitted.
5	Elijah Brainard & Thos. H. Benton	60	1 75	1 40	6 87	do	June 30, 1883
	Frank C. Somers...	43½	.....	.....	.....	Mar. 15, 1883	June 15, 1883

Contract awarded to Samuel R. Cumming, the lowest responsible bidder, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

Vessels cleared and entered from June 30, 1882, to June 30, 1883.

Class.	Number.	Total tonnage.	Draught.
			Feet.
Steamers (tugs)	291	Not known.	5 to 7
Barges	240	48,000	5 to 7
Schooners	20	2,800	4 to 7
Sloops	26	1,300	4 to 6

EXPORTS.

	Tons.
Molding sand	11,400
Clay	5,200
Fine sand for use of foundries and glass houses	9,500

IMPORTS.

The imports consist of manure, coal, gas-house lime, poudrette, and general merchandise, and are comparatively small in amount.

F 8.

IMPROVEMENT OF THE PASSAIC RIVER ABOVE NEWARK, NEW JERSEY.

The proposed improvement was adopted in 1872, and provides for the formation and maintenance, by means of dredging and training-dikes, of a channel 100 feet wide and 6 feet deep at low water, from Newark to the head of navigation at Dundee Dam.

At the time work was suspended in 18 0, all of the obstructing bars had been worked upon and narrow channels through them not exceeding 75 feet wide with the requisite 6 feet depth had been opened.

The commerce of the upper river is of limited extent and is carried in one or two boats which make regular daily trips between Newark and Passaic. Since the freshets of the spring of 1883 subsided a preliminary examination was made which showed that the regular boats have a conveniently navigable channel to Passaic, except over the shoals, in the lower river near Newark from Midland Railroad Bridge of New Jersey to the Erie Railroad Bridge, Newark, a distance of 2 miles. The amount available during the fiscal year ending June 30, 1883, was $9,452.62. No work was done.

Sealed proposals, to be opened in the office July 27, 1883, are invited for dredging a channel 100 feet wide and 6 feet deep, at mean low water, through the obstructing shoals mentioned above.

The amount on hand is too small to provide for the construction of any part of the system of dikes embodied in the original project.

So far as known, the governor of the State of New Jersey has taken no action relative to the appointment of commissioners for the purpose of examining into the propriety of building a dam across the river near Belleville to protect the interests of water supply to Jersey City.

The amount of the original estimate for limited improvements was $123,924.

The amount appropriated from act June 10, 1872, to act of August 2, 1882, both inclusive, was $121,000.

The appropriation of $3,000 asked for is to widen the improved channels to the extent of the estimate of the original project.

The act of August 2, 1882, provided for a survey of the river from Passaic to Paterson with the view of extending the navigation to the latter point by a system of locks and dams. The report will be submitted to Congress at its next session.

Money statement.

July 1, 1882, amount available	$2,452	62
Amount appropriated by act passed August 2, 1882	7,000	00
	9,452	62
July 1, 1883, outstanding liabilities	53	50
July 1, 1883, amount available	9,399	12
Amount (estimated) required for completion of existing project	3,000	00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	3,000	00

F 9.

IMPROVEMENT OF PASSAIC RIVER FROM THE PENNSYLVANIA RAILROAD BRIDGE TO ITS MOUTH, NEW JERSEY.

The project for this improvement was adopted in 1880, and provides for the formation and maintenance by means of dredging and a system of training-dikes, of a channel 200 feet in width and 10 feet in depth at mean low water, from Pennsylvania Railroad Bridge (Centre street, Newark) to Newark Bay.

At the close of the fiscal year ending June 30, 1882, a contract was in progress with Elijah Brainard, jr., for continuing the improvement by dredging at the entrance; the amount available being $9,929.82. This contract was closed November 6, 1882. The total amount of material dredged was 173,986 cubic yards.

The improved channel for the full width of 200 feet, was carried through the draws of the Newark and New York Railroad Bridge, and the outlet to Newark Bay was widened for the convenience of vessels to 400 feet. The river and harbor act of August 2, 1882, appropriated $43,000 for continuing the improvement. Sealed proposals invited by public advertisement, were opened September 21, and the contract for dredging was awarded to Messrs. Morris & Cumings, the lowest bidders, at 22½ cents. Work began under the contract October 23, 1882, and up to the close of the season, December 8, when work was suspended, 14,175 cubic yards had been removed. Work was resumed April 3, 1883, and is still in progress. The total amount removed under the contract during the fiscal year is 55,007 cubic yards. No appropriation was made for continuing the improvement for the fiscal year ending June 30, 1884, and as the river from the Newark and New York Railroad Bridge to the lower wharves of Newark, a distance of 3½ miles, has many shoals obstructive to navigation, the width of the improved channel has been reduced to 100 feet, so that shipping may get immediate relief from the existing appropriation; leaving the channel to be widened to 200 feet by future appropriations. Under this project the improved channel with a width of 100 feet has been carried to a point about 3,300 feet above the toll-bridge, and it is expected that it will be extended, under the contract, to the Pennsylvania Railroad Bridge at Centre street, Newark.

The original estimate for this improvement provided for the removal of 291,000 cubic yards of material, measured in place, from the enterance to Pennsylvania Railroad *lower* bridge in the city of Newark; the approved project contemplated extending the improvement to the *upper* bridge, requiring the removal of 26,000 cubic yards additional dredging, and making the total removal 317,000 cubic yards measured in place.

It is to be observed that this estimate is for dredging to a plane of 10 feet at mean low water, and to make a channel which will be available for vessels drawing 10 feet at mean low water; the cutting must be carried 1 foot approximately below the adopted plane to avoid the irregularities always appearing in dredged channels.

This increased depth, taken in connection with the increase in bulk of material when deposited upon scows, and a small percentage for shoaling in the river, swells the estimate of the amount to be removed to 589,000 cubic yards measured upon scows. The amount actually removed from the beginning of the improvement to the close of the fiscal year ending June 30, 1883, is 284,992 cubic yards. The channel at the entrance is made 400 feet wide, for a distance of a few hundred feet, for convenience of vessels in entering; thence is carried 200 feet to the New York and Newark Railroad Bridge; thence it is 130 feet wide for a distance of 1,000 feet, and thence is only 100 feet wide for a farther distance of 6,000 feet.

To complete the 200-foot channel from the entrance to Centre street Bridge, Newark, will require the removal of 150,000 cubic yards of material. To maintain the improved channel it will be important, also, to build 5,000 feet of diking from below the toll bridge to the zinc works. For these improvements an appropriation of $85,000 is asked.

The manufacturing interests centered at Newark and along the Passaic River to the mouth are of the most important and substantial character, and are growing in value and extent every day. The river is a grand highway for vessels of every class, and should be maintained in a state of efficiency compatible with the interests involved.

The appended commercial statistics show the commercial value of the river, and especial attention is invited to them. Over 20,000 vessels passed the draw of the New York and Newark Railroad during the year.

Passaic River is in the collection district of Newark, which is the nearest port of entry. Nearest light-house, Passaic light. Fort Tompkins is the nearest fort.

Amount of revenue collected during year, $12,082.15.

Amount appropriated from June 14, 1880, to August 2, 1882, both inclusive	$123,000 00
Original estimate for diking and dredging	232,875 00
Total amount expended, exclusive of outstanding liabilities	94,174 70

Money statement.

July 1, 1882, amount available		$9,929 82
Amount appropriated by act passed August 2, 1882		43,000 00
		52,929 82
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$21,068 87	
July 1, 1883, outstanding liabilities	3,035 65	
		24,104 52
July 1, 1883, amount available		28,825 30
Amount (estimated) required for completion of existing project		85,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		85,000 00

Abstract of proposals for improving Passaic River from Pennsylvania Railroad Bridge to mouth, New Jersey; opened September 22, 1882, by Maj. G. L. Gillespie, Corps of Engineers.

No.	Names of bidders.	Price.	Date of commencement.	Date of completion.
		Per cu.yd.		
1	Elijah Brainard and Thomas H. Benton	$0 35	July 1, 1883	Dec. 15, 1883
2	Morris & Cumings Dredging Company	22½	Omitted	Omitted.
3	John H. Fenner	29	do	Do.
4	Edgar M. Payne	24. 9	Nov. 1, 1882	Dec. 1, 1883
5	John McDermott	41	Oct. 1, 1882	Nov. 1, 1883
6	John W. and Daniel Ambrose and Robert J. Mills	55	Omitted	Omitted.

Contract awarded to Messrs. Morris & Cumings, the lowest responsible bidders, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

I am indebted to Mr. William J. Martin, special deputy collector at Newark, for the following statistical information for the fiscal year ending June 30, 1883:

Total amount of collections	$12,082.15
Value of imports	70,526.00
Value of exports	36,247.00
Foreign vessels entered from foreign ports	25
Tonnage	4,428
Foreign vessels cleared to foreign ports	37
Tonnage	5,362
American vessels entered from foreign ports	46
Tonnage	6,933
American vessels cleared to foreign ports	5
Tonnage	931
Coastwise entries	35
Tonnage	6,114
Coastwise clearances	6
Tonnage	1,433

The following extract from report made to Newark Board of Trade by committee on Passaic River was furnished by the chairman, Edmund L. Toy, esq.:

The work of improving the channel of the Passaic River from the bay to Centre Street Bridge has been prosecuted with reasonable activity, and the work is so far advanced as to justify the belief that the plan adopted by the Government engineers is correct and that the union of the rivers Hackensack and Passaic will maintain a good depth of water at the point where these rivers join the bay.

It is very important that the dredging of the river should be completed at once. A free current, of good depth and width, is essential to the maintenance of the improvement already made and to secure the results sought after. Owing to the failure of Congress to make any appropriation for this work last year, it will be impossible to complete the work, although the unexpended balance will be used to the best advantage. We urge that this Board ask the next Congress to appropriate enough money to finish the work without further delay according to the original plan.

The improvement in navigation is already noticed both in the avoidance of delays and in the increased tonnage of the vessels that can now enter the river.

It is of vast importance to the people of Newark and Northern New Jersey that the Passaic should be maintained at its fullest capacity. If the commerce was much less than it is, it would justify the expenditure of all the money needed for its preservation as a highway for vessels. It gives our people lower rates than we otherwise would have, besides the facility with which heavy freight is moved.

The amount of revenue collected during the fiscal year ending June 30, 1883, was $12,082.15.

The number of vessels engaged in the river for year 1882, as reported at the drawbridge, is 20,581, and the actual freight carried is about the average of the two past years, 1,000,000 tons.

F 10.

IMPROVEMENT OF CHANNEL BETWEEN STATEN ISLAND AND NEW JERSEY.

The approved project for this improvement provides for the formation of a channel 400 feet wide, 100 feet on either side of the axial line, to have 13 feet depth at mean low water, and the residue only 12 feet, with deflecting dikes on both sides, if the dredged channel cannot otherwise be maintained. The amount available during the year was $43,828.65, and was applied in widening and deepening the channel between Kill-von-Kull and Arthur's Kill.

Sealed proposals, invited by public advertisement, were opened September 21, 1882, and the contract awarded to Messrs. Morris & Cummings, the lowest bidders, at 23¾ cents per cubic yard.

Work was commenced under the contract October 16, and was completed May 23, 1883. The total amount removed was 158,637 cubic yards.

The improved channel has been maintained throughout the year better than was anticipated, and I am not yet prepared to recommend the construction of any deflecting dikes; whilst they direct the flow along the improved channel and give excellent channels of restricted width for steam-vessels, they are not so favorable for sailing vessels, which require more room for tacking. As the only shoaling particularly noticeable has been immediately around the stake-light—where even 1,000 cubic yards only were required to be removed—it would seem that the construction of the dikes may be deferred until commerce demands a greater depth of water to Elizabethport. Until that time comes it will be better to maintain the improved channel by dredging at those points where deposits are found to take place.

From the east of Shooter's Island to the west channel leading past the wharves of Elizabethport, there is now an open channel-way 400 feet wide, with a least depth of 12 feet at mean low water, affording a channel 200 feet wide, with 13 feet at mean low water along the axis.

It is recommended that the channel be deepened, so that it may have a uniform depth of 13 feet throughout the width of 400 feet. This will require the removal of 50,000 cubic yards, at a total cost of $20,000.

The appropriation of $25,000 asked for is to make this improvement and to provide for contingencies of removal of deposits. This is a most important highway for commerce, and the channel, which has been improved, should not be allowed to decline through neglect. The probabilities are that the great increase in the shipping predicted for Elizabethport will require in the near future as much as 16 feet depth in the channel at mean low water.

This work is in the collection district of New York, which is the nearest port of entry; nearest light-house, Bergen Point light; the nearest fort is Fort Tompkins.

Amount of revenue collected at the port of New York during the fiscal year ending June 30, 1883, was $147,901,488.93.

Original estimate	$185,705 00
Amount expended exclusive of outstanding liabilities	92,204 62
Amount appropriated from August 14, 1876, to August 2, 1882, both inclusive	94,000 00

Money statement.

July 1, 1882, amount available	$3,828 65
Amount appropriated by act passed August 2, 1882	40,000 00
	43,828 65
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	42,033 27
July 1, 1883, amount available	1,795 38
Amount (estimated) required for completion of existing project	93,698 63
Amount that can be profitably expended in fiscal year ending June 30, 1885	25,000 00

Abstract af proposals for improving channel between Staten Island and New Jersey, opened September 21, 1882, by Maj. G. L. Gillespie, Corps of Engineers.

No.	Name of bidders.	Price.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	Chandler H. Loomis	$0 24	(*)	(*)
2	Elijah Brainard and Thomas H. Benton	34	Nov. 13, 1882	July 31, 1883
3	Morris & Cumings Dredging Company	23¾	Omitted	Omitted.
4	John W. & Daniel Ambrose & Robt. J. Mills	40	do	Do.

* 120 working days.

Contract awarded to Morris & Cumings Dredging Company, the lowest responsible bidders, with the approval of the Chief of Engineers.

F 11.

IMPROVEMENT OF SHREWSBURY RIVER, NEW JERSEY.

The project for this improvement was adopted in 1879, and provides for the formation of a channel 6 feet deep at low water from the entrance to Oceanic Dock, on the North Branch, and to Pleasure Bay, on the South Branch.

The amount available July 1, 1882, was $19,507.01, and dredging operations were in progress under two contracts, one with Wm. H. Wood for improving the South Branch from Seabright to Pleasure Bay, and the other with Elijah Brainard, jr., for dredging the entrance to the river and the North Branch. The latter contract closed September 20; the total amount of material removed was 41,414 cubic yards. A channel 75 feet wide and 6 feet deep at mean low water was excavated across the bar at the entrance, and a cut 50 feet wide was made through a shoal which had formed in the North Branch abreast of the opening in the dike at Barley Point.

The former contract was closed November 22; the total amount removed was 60,523 cubic yards, including 1,000 cubic yards of cemented sandstone from the ledge above the Seabright Bridge.

Under the contract a channel 150 feet wide with 6 feet at mean low water was opened from the deep water in front of Seabright to the deep water of Pleasure Bay, and a cut 50 feet wide with 7 feet mean low water was made through the rocky ledge at Seabright Bridge.

The river and harbor act of August 2, 1882, appropriated $30,000, one-half to be applied in the South Branch, and the other half in the North

Branch and Main Stem. Sealed proposals invited by public advertisements were opened September 22, 1882, and the contract awarded to Elijah Brainard, the lowest bidder, for dredging 67,000 cubic yards of material at $35\frac{3}{4}$ cents per cubic yard, and for building 500 linear feet of sheet pile diking at $5.50 per linear foot.

Work under the contract was commenced October 10, and by the latter part of November the dike extending northward from the lower end of Sedge Island, near the entrance to Pleasure Bay, was completed; as built it was just 503 feet long. The dredging commenced at the shoal just below the Highlands Bridge. Here a channel 100 feet wide and 800 feet long was opened, and the main channel from the draw for 1,000 feet northward was widened 25 feet to enable boats to enter with facility the channel leading to the east side of Island Beach.

On the 6th December the dredges drew off on account of ice, after the removal of 14,445 cubic yards of material.

Operations were resumed on the 13th April, 1883, work commencing in the North Branch opposite the opening between the dikes on the south side, where a shoaling of at least 1 foot had taken place during the year. The improved channel in the North Branch can never be maintained, except by annual dredging, until the breach in the south dike is closed. This breach is known as Dike C in the report of January 11, 1879; it is 1,400 feet long, and should be built as early as possible. A part of the flood-tide which enters the South Branch passes into the slough below Barley Point, and thence out into the North Branch directly across the improved channel, tending to impair it; with like effect the ebb-tide sets across the improved channel and slough in the opposite direction, causing the North Branch in the existing condition of the improvement to undergo continual change and degradation.

It is confidently believed that the channel of the North Branch will be subject to only very slight shoalings if the diking is made continuous on the south side.

At the close of the year the contractor had made a cut in the North Channel 100 feet wide, 2,150 feet long, with 6 feet at mean low water, having removed 33,788 cubic yards, giving an aggregate to date, under his control, of 55,381 during the year. The residue of the appropriation will be applied in deepening the channel in the South Branch extending up stream from the junction with the North Branch.

The appropriation of $50,000 asked for will be applied in deepening the North Branch by dredging and building 1,400 linear feet of diking on the south side, in deepening the South Branch to Seabright Bridge, in maintaining the channel below Highlands Bridge, and in widening, deepening, and maintaining the channel at the entrance.

The increase of the original estimate for the improvement by $33,000 is occasioned by the shoaling in the North Branch, causing a second dredging arising from the incomplete state of the training dikes projected for that channel, the shoaling below the Highlands Bridge, and the removal of rock near the Seabright Bridge, not contemplated in the project.

Shrewsbury River is in the collection district of Perth Amboy, N. J.; nearest port of entry, New York. The nearest light-house is Navesink light, and fort at Sandy Hook is the nearest fort.

Amount of revenue collected during fiscal year ending June 30, 1883, ——

Original estimate (revised)	$244,500 00
Amount appropriated from August 30, 1852, to August 2, 1882, both inclusive	194,500 00
Amount expended, exclusive of outstanding liabilities	177,488 16

Money statement.

July 1, 1882, amount available		$19,507 01
Amount appropriated by act passed August 2, 1882		30,000 00
		49,507 01
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$32,495 17	
July 1, 1883, outstanding liabilities	4,056 78	
		36,551 95
July 1, 1883, amount available		12,955 06
Amount (estimated) required for completion of existing project		50,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		50,000 00

Abstract of proposals for improving North and South branches of Shrewsbury River, New Jersey, opened September 22, 1882, by Maj. G. L. Gillespie, Corps of Engineers.

No.	Names of bidders.	Price of dredging.	Price of diking (500 feet).	Date of commencement.	Date of completion.
		Per cu. yd.	*Per lin. ft.*		
1	Elijah Brainard	$0 35¾	$5 50	Oct. 15, 1882	Oct. 30, 1883
2	Henry DuBois & Sons	No bid	5 00	Omitted	Omitted.
3	Frank Pidgeon, jr.	$0 48 3/10	4 00	do	Do.

Contract awarded to Mr. Elijah Brainard, the lowest responsible bidder, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

Exports.

Articles.		Value.	Quantity.
Straw	tons	$3,750	250
Hay	do	4,500	250
Fruits		600,000	.....
Potatoes	barrels	112,500	75,000
Garden truck		160,000	.....
Clams	barrels	7,500	3,000
Oysters	baskets	200,000	100,000
Fish		150,000	.....
Miscellaneous merchandise		55,000	.....
Total value of exports		1,293,250	.....

Imports.

Articles.		Quantity.	Value.
Oysters	bushels	210,000	$42,000
Peaches	baskets	20,000	15,000
Hardware		.....	157,500
Lumber	feet	5,250,000	152,500
Cement	barrels	3,000	3,500
Plaster	do	2,500	2,750
Lime	do	3,000	3,000
Shingles	number	450,000	6,750
Lime-stone and building stone		.....	2,500
Guano	tons	250	150,000
Coal	do	45,500	182,000
Phosphate		.....	6,000
Brick	number	3,500,000	21,000
Agricultural lime	bushels	60,000	5,100
Gas lime	do	10,000	400
Shell-lime		.....	800
Manure		.....	7,000
Saw-dust	barrels	3,000	900
Lath	number	2,000,000	4,000
Glass		.....	6,500
Paint		.....	10,000
Ice	tons	1,200	6,000
Miscellaneous merchandise		.....	777,500
Total value of imports		.....	1,562,700

Arrival and departure of vessels.

Class.	No.	Tonnage.	Crews.
Steamers	1,400	470,000	14,500
Sailing vessels	1,300	55,000	4,000
Total	2,700	525,000	18,500

Fares received from passengers on steamers, $30,000.

F 12.

IMPROVEMENT OF RAHWAY RIVER, NEW JERSEY.

The existing project, adopted in 1878, provides for the formation of a channel 8 feet in depth at mean high water, extending from Bricktown up to Monroe Street Bridge, in the town of Rahway, at the head of navigation.

On July 1, 1882, the work of improvement was in progress under contract with Mr. William Chamberlain, and the channel 50 feet wide had been carried to a point 200 feet above Milton Avenue Bridge. This contract was closed August 28, the total amount removed by contractor being 13,943 cubic yards.

A channel 45 feet wide, approximately, with 7 feet at mean high water, was carried up stream from Tappan's Wharf through the east draw of Milton Avenue Bridge to a point 75 feet above Chamberlain's Dock; a second channel leading through the west draw of the same bridge was opened from 300 feet below the draw to the draw itself, when work was suspended by the exhaustion of the appropriation.

Act of August 2, 1882, appropriated $7,000 to continue the improvement. Sealed proposals invited by public advertisement were opened in this office September 22, and the contract was awarded to William Chamberlain, the lowest bidder, at 78 cents per cubic yard. Operations were commenced June 1, and are now in progress. Up to the close of the fiscal year 4,165 cubic yards have been removed, and the channel through the west draw of Milton Avenue Bridge has been carried 450 feet beyond the bridge.

The interests dependent upon this improvement consist principally of general merchandise, coal, and lumber, pertaining to Rahway at the head of navigation.

There has been no increase in the tonnage over past years, influenced by the unusual depression in trade, and in a partial degree, no doubt, by the destruction to local industries by the freshet in the Rahway River in the early spring of 1883.

The appropriation of $10,000 asked for will be applied towards continuing the existing project.

This work is in the collection district of Perth Amboy, N. J., which is the nearest port of entry. The nearest light-house is Prince's Bay light. Fort Tompkins is the nearest fort.

Amount appropriated from March 3, 1879, to August 2, 1882, both inclusive, was $37,000. Amount of revenue collected during the fiscal year ending June 30, 1883, ——.

Original estimate	$66,250 00
Amount expended, exclusive of outstanding liabilities	30,210 68

Money statement.

July 1, 1882, amount available		$4,556 18
Amount appropriated by act passed August 2, 1882		7,000 00
		11,556 18
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$4,766 86	
July 1, 1883, outstanding liabilities	3,254 30	
		8,021 16
July 1, 1883, amount available		3,535 02
Amount (estimated) required for completion of existing project		29,250 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		10,000 00

Abstract of proposals for improving Rahway River, New Jersey, opened September 22, 1882, by Maj. G. L. Gillespie, Corps of Engineers.

No.	Names of bidders.	Price.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	John McDermott	$0 94	Omitted	June 30, 1883
2	William Chamberlain	78	do	July 30, 1883
3	Elijah Brainard and Thomas H. Benton	1 00	do	Omitted.

Contract awarded to William Chamberlain, the lowest responsible bidder, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

I am indebted to Mr. William Chamberlain, a prominent business man of Rahway, N. J., for the following information relative to the commerce of Rahway River:

Names of shippers, &c.	Articles.	Tons.
Russell Coe	Poudrette, &c	2,000
Pottery Dock	Clay, &c	1,000
Hampton Cutler & Sons	Coal and lime	5,000
Brokaw & Co	Timber shippers	3,000
Public Dock	Miscellaneous stores	5,000
James Mays	Timber shippers	3,000
Edgar's Dock	Miscellaneous stores	1,000
Michael Friese	Coal	2,000
E. T. Tappan & Co	do	2,000
Samuel Ayres	do	2,000
Brewster & Co	Coal and timber	5,000
William Chamberlain	Coal, brick, &c	10,000
Ayres & Lufbery	Lumber	4,000
Do	Rafts and timber	5,000
Rahway Gas Company	Coal	1,000
Total		51,000

Mr. Chamberlain further states:

"There are also shipped from Rahway miscellaneous cargoes of merchandise. Tonnage has not decreased nor increased the past year. If the river had not been dredged the tonnage would not amount to hardly anything, as we had only 3½ to 4 feet of water on the average high-tide.

"The improvement of our river not being completed on account of not having any more appropriation to expend, the increase of tonnage, such as a line of steamboats, have not been put on. Rahway has a population of 7,000 to 8,000 people. We have a number of large carriage factories, printing-press works (Gordon's), woolen mills, rubber mills and factories, hub and spoke shops, and a number of others, who are all interested in having the improvements on Rahway River."

F 13.

IMPROVEMENT OF THE ELIZABETH RIVER, NEW JERSEY.

The existing project for this improvement provides for deepening the existing channel by dredgidg to a depth of 7 feet at mean high water, the improved channel to be 60 feet wide, and to extend to the stone bridge at Broad street, in the town of Elizabeth.

At the close of the fiscal year ending June 30, 1882, the improvement had reached the iron draw-bridge at South street in the city of Elizabeth, but there was no balance on hand to extend it. By act of August 2, 1882, $8,000 was appropriated for continuing the improvement. Sealed proposals, invited by public advertisement, were opened in this office September 22, and the contract for dredging up stream, for the full width of 60 feet, as far as the appropriation would admit, was awarded to Mr. Frank C. Somers, of Philadelphia, at 64 cents per cubic yard. Operations under the contract were commenced May 26, and are still in progress. The amount of material removed to the close of the fiscal year is 4,142 cubic yards, and the improved channel 25 to 50 feet wide and 7 feet deep; mean high water has been carried up stream a distance of 1,600 feet from South Street Bridge.

As was stated in my last annual report, this river has materially shoaled in its upper reach since the work of improvement under existing project was commenced, due chiefly to deposits from city sewers, and, on the basis of last year's estimate, $16,200 still remain to be appropriated to complete the project.

The tonnage of merchandise carried in and out of this stream has not changed during the year, and will not exceed 20,000 tons. The vessels navigating the stream are canal barges and the smaller class of sailing vessels, but they render useful service to the gas-works, potteries, and lumber-yards located upon its banks.

Elizabeth is in the collection district of Newark, N. J.; nearest light-house, Newark Bay, New Jersey, and the nearest fort is Fort Tompkins.

Amount of revenue collected during the fiscal year ending June 30, 1883, $12,082.15.

Amount appropriated from March 3, 1879, to August 2, 1882, both inclusive	$27,000 00
Original estimate	43,160 00
Amount expended, exclusive of outstanding liabilities	19,204 54

Money statement.

Amount appropriated by act passed August 2, 1882		$8,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$204 54	
July 1, 1883, outstanding liabilities	2,348 51	
		2,553 05
July 1, 1883, amount available		5,446 95
Amount (estimated) required for completion of existing project		16,160 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		16,200 00

Abstract of proposals for improving Elizabeth River, New Jersey, opened September 22, 1882, by Maj. G. L. Gillespie, Corps of Engineers.

No.	Names of bidders.	Price.	Date of commencement.	Date of completion.
		Per cu. yd		
1	John McDermott	$1 24	Omitted	June 30, 1883
2	Thomas H. Benton	1 20	....do	June 1, 1883
3	Frank C. Somers	63	April 1, 1883	June 15, 1883

Contract awarded to Mr. Frank C. Somers, the lowest responsible bidder, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

I am indebted to Mr. Charles C. McBride for the following statistical information. A comparison with the report of the preceding year will show an apparent increase of 50 per cent. in the total tonnage during the fiscal year ending June 30, 1883.

Statement showing tonnage of merchandise and materials shipped through Elizabeth River, N. J., from July 1, 1882 to July 1, 1883.

No.	Shippers and receivers.	Materials, &c.	Tonnage.		Total tonnage.
			Shipped.	Received.	
			Tons.	*Tons.*	*Tons.*
1	T. & S. S. Thompson	Lumber and lime		1,500	1,500
2	Moses W. Mulford	do		1,700	1,700
3	Elizabeth Gas Company	Coal		3,000	3,000
4	T. F. & H. C. Sayre	Lime, fire-brick, &c		1,000	1,000
5	F. J. Blatz	Hides, leather, stone, &c		1,000	1,000
6	James Butler	Sand, &c		1,000	1,000
7	P. Sheridan	Lumber		100	100
8	A. Heidritter & Sons	Lumber, brick, &c	260	7,900	8,160
9	Wood Preserving Companies dock	General merchandise		1,000	1,000
10	W. H. Rankin	Gravel, pitch, tar		150	150
11	Elizabethport Milling Company	Barytes	1,500	3,700	5,200
12	Elizabeth Cordage Company	Hemp, rope, coral	1,500	5,500	7,000
	Total		3,260	27,550	30,810

F 14.

IMPROVEMENT OF WOODBRIDGE CREEK, NEW JERSEY.

The project for this improvement was adopted in 1878, and provides for a uniform depth of 12 feet at mean high water in a channel 80 feet wide from the mouth of the creek as far up as Salamander dock.

At the close of the fiscal year ending June 30, 1882, the improvement had been carried from the entrance to a short distance above Anderson's dock, giving a navigable channel 50 feet wide, with 12 feet at high water. The amount available July 1, 1882, was nothing.

By act of August 2, 1882, $5,000 was appropriated for continuing the improvement; under this act sealed proposals invited by public advertisement were opened in the presence of bidders September 22, 1882, and the contract for dredging awarded to Elijah Brainard, the lowest responsible bidder, at 65 cents per cubic yard.

Work was commenced on the 18th December, and the contract closed on the 17th January, 1883; the total amount removed being 6,880 cubic yards. By the contract the 12-foot curve, mean high water, was carried up stream from Anderson's Wharf to Valentine's Wharf, covering a distance along the channel of 3,200 feet. The improved channel is now 50 feet wide to Cutter's clay-dock, and thence to Valentine's dock it is but 25 feet wide. The total amount of material removed from the river since the beginning of the project is 26,758 cubic yards.

The removal of 7,242 cubic yards will complete the existing plan. The head of navigation is at town dock, 800 feet above Valentine's dock. By increasing the depth between these docks to 12 feet in a channelway 50 feet wide, every commercial requirement of the creek will be satisfied.

At the time of the adoption of the present project there was a depth of 6½ feet at mean high water at town dock and 9½ feet at the entrance; at the present there is 9 feet at the former and 12 feet at the latter.

The facilities for the transportation of the products of the valley have been much increased by the improvement, and the stimulus given to commerce leads me to recommend that the improvement be continued until the existing plan is fully carried out.

Woodbridge Creek is in the collection district of Perth Amboy, N. J., which is the nearest port of entry; the nearest light-house, Prince's Bay; and nearest fort, fort at Sandy Hook.

Amount of revenue collected during the fiscal year ending June 30, 1883, ——.

Amount appropriated from March 3, 1879, to August 2, 1882, both inclusive.	$19,000
Original estimate	23,000
Amount expended, exclusive of outstanding liabilities	19,000

Money statement.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	5,000 00
Amount (estimated) required for completion of existing project	4,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	4,000 00

Abstract of proposals for improving Woodbridge Creek, New Jersey, opened September 22, 1882, by Maj. G. L. Gillespie, Corps of Engineers.

No.	Names of bidders.	Price.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	John McDermott	$0 74	Omitted	June 30, 1883
2	John M. Weldon	73	do	July 15, 1883
3	John H. Fenner	65	do	June 30, 1883
4	Elijah Brainard & Thomas H. Benton	65	do	June 30, 1883
5	Frank C. Somers	75	April 15, 1883	June 15, 1883

Contract awarded to Elijah Brainard & Thomas H. Benton, the lowest responsible bidders, with the approval of the Chief of Engineers.

F 15.

IMPROVEMENT OF MANASQUAN RIVER, NEW JERSEY.

The original project for this improvement, which was adopted in 1879, has for its object the improvement of the river entrance by a system of lateral jetties, to confine the waters of the inlet to a single channel-way across the beach, and to make the inner harbor available for purposes of commerce.

At the close of the last fiscal year the north jetty had been completed for a length of 1,515 feet from the initial point, and the amount available for further operations was reduced to $1,518.92. The river and harbor act of August 2, 1882, appropriated $7,000 for continuing the improvement. Sealed proposals, invited by public advertisement, were opened in this office September 26, for the construction of a part of the projected south jetty, and the contract was awarded to Stephen A. Kelly, the lowest responsible bidder, at $11, $9, and $8 per linear foot, respectively, for the timber work of different cross-sections, and $2.50

per cubic yard for stone filling. Operations were commenced in November, and the contract was closed at the end of the fiscal year.

The south jetty, so far as built, is 475 feet long, the outer end being 100 feet inside of the outer end of the north jetty. Starting at the outer end, at a distance of 200 feet from the north pier, the south jetty is formed by driving two parallel rows of piles 12 feet from inside to outside, the piles on the channel side in contact and those in the back row 6 inches apart. The piles in each row are sawed off at 1 foot above mean high water, and confined longitudinally by waling timbers, and transversely at intervals of 12 feet by cross-ties. The space between the rows is filled with stone. The first 100 feet of the south jetty is parallel to the north jetty, but the inner end of the second hundred feet is 240 feet from that jetty; the remaining 275 feet of jetty is only 5 feet wide and is thrown back from the channel so as to deflect the current of the river towards the center of the channel and to prevent the cutting of the beach behind the jetty. The inshore part is still too short, and should be extended 300 feet inshore towards the adjacent meadow, to remove all apprehension of the currents making a breach through the South Beach.

A careful examination was made of the inlet the latter part of April, and it was noticed as the result of the construction of the two jetties that the entrance was very much improved; the channel over the outside bar was more direct and of more uniform depth, and the inner basin had not only undergone no deterioration, but had gained a partial increase of depth.

The dunes north of the inlet have increased in height and the beach line has advanced outwards; and the lagoon north of the north jetty has very materially diminished in depth and extent, thereby increasing the probability of the future maintenance of the inshore part of that jetty. The inlet is in a very encouraging condition, and I would recommend a continuance of the construction of the north jetty, which appears to be the more important one.

After frequent observations of the inlet during the past year at all stages of the tide, I am of the opinion that an extension of the north pier for a distance of 500 feet, and of the south jetty for 300 feet, will increase the facilities for entering and will probably deepen the channel over the bar from 1 to 2 feet. For making these extensions and the inshore extension of the south jetty, the sum of $25,000 is asked.

The commerce of the harbor is, as yet, insignificant, because mariners have never had the assurance that they could bring their vessels in safely.

The contractor has found no difficulty in bringing his scows across the bar when the wind was easterly, and it is believed that, under like conditions, at high tide, fishing vessels and small schooners, drawing 6 to 7 feet, can easily make the harbor.

Great numbers of sailing vessels pass the inlet, going both ways, along the southern coast of New Jersey, to which this harbor would be a great convenience if they could only enter it without danger.

Manasquan River is in the collection district of Perth Amboy, N. J., which is the nearest port of entry; nearest light-house is Barnegat light, and nearest fort, fort at Sandy Hook.

Amount of revenue collected during the fiscal year ending June 30, 1883, ——

Original estimate (revised)	$72,000 00
Amount expended exclusive of outstanding liabilities	32,874 46
Amount appropriated from March 3, 1879, to August 2, 1882, both inclusive.	39,000 00

Money statement.

July 1, 1882, amount available		$1,518 92
Amount appropriated by act passed August 2, 1882		7,000 00
		8,518 92
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$2,393 38	
July 1, 1883, outstanding liabilities	6,124 01	
		8,517 39
July 1, 1883, amount available		1 53
Amount (estimated) required for completion of existing project		33,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		25,000 00

Abstract of proposals for improving Manasquan River, New Jersey, opened September 26, 1882, by Maj. George L. Gillespie, Corps of Engineers.

No.	Names of bidders.	Price of timber jetty.	Price of stone in jetty.	Date of commencement.	Date of completion.
		Per linear foot.	*Per cu. yd.*		
1	Stephen A. Kelly ..	For outer 200 feet ..... $11 00 For following 100 feet ... 9 00 For inner 200 feet..... 8 00	$2 50	Omitted	June 1, 1883
2	Henry DuBois & Sons.	13 50	5 00	....do	Omitted

Contract awarded to Stephen A. Kelly, the lowest responsible bidder, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

One sloop, of about 40 tons burden, makes regular trips between Manasquan, New York, and points South. Her cargo consists principally of seed oysters, lime, coal, and coal-dust, the latter being used for brick making. She generally goes out light. About twenty boats are engaged in fishing, giving employment to about fifty men. There are no manufacturing establishments located on the river. During the summer season fifteen sail-boats are engaged in carrying passengers from the upper sections of the river to the sea-shore and back, and about twenty-five boats, owned by summer residents are used for purposes of pleasure. During the past spring several light-draught coasting vessels have put into the river for a harbor.

F 16.

IMPROVEMENT OF RARITAN BAY, NEW JERSEY.

The project for this improvement was adopted in 1880, and provides for dredging a channel 300 feet wide and 21 feet deep at mean low water, across the shoal off Seguine Point. This shoal separates the deep water of the main ship-channel in Raritan Bay from the deep water to the west of Seguine Point, Staten Island, and is a serious obstruction to deep-draught vessels seeking the harbor of Perth Amboy, N. J.

The least depth on the shoal at the time the improvement began was only 14½ feet, mean low water. At the opening of the fiscal year only 100 feet of the projected 300 feet width of channel across the shoal had been improved.

The amount available towards a continuance of the improvement during the year was $50,207.13. The river and harbor act of August 2, 1882, appropriated $50,000. Sealed proposals, invited by public advertisement, were opened in the office September 21, 1882, and the contract

awarded to the Atlantic Dredging Company, the lowest bidder, at 22 cents per cubic yard.

The improvement was resumed under this contract May 14, 1883, after the spring opened sufficiently to authorize the dredges to commence work in the exposed bay; and up to the close of the fiscal year 56,200 cubic yards were removed in widening the channel on the north side, the limit of the increased width being 35 feet. It was stated in the last annual report that vessels were often detained in the narrow channel off Ward's Point, at the southwestern extremity of Staten Island, where the depth is only 17½ feet; the obstruction still exists there, and it is highly important that the existing depth in that narrow channel should be increased to equal that in the channel off Seguine Point now in process of improvement.

The channel in front of the wharves at Perth Amboy has a depth ranging from 23½ to 41 feet, mean low water, and if vessels drawing 20 feet could reach these wharves from the outer bay at all stages of the tide the benefits accruing to commerce and to the port would be proportionately increased.

The appropriation of $60,000 which is earnestly recommended to accomplish this result will be applied in completing the existing project in the Seguine Channel, and in deepening and widening the narrow channel off Ward's Point.

This work is in the collection district of Perth Amboy, N. J.

Nearest port of entry, Perth Amboy, N. J.; nearest light-house, Prince's Bay, and nearest fort, fort at Sandy Hook.

Amount of revenue collected during the fiscal year ending June 30, 1883, ——.

Original estimate (revised)	$160,000 00
Amount appropriated from March 3, 1881, to August 2, 1882, both inclusive.	100,000 00
Amount expended exclusive of outstanding liabilities	50,620 81

Money statement.

July 1, 1882, amount available		$207 53
Amount appropriated by act passed August 2, 1882		50,000 00
		50,207 53
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$828 34	
July 1, 1883, outstanding liabilities	12,364 00	
	13,192 34	
July 1, 1883, amount available		37,015 19
Amount (estimated) required for completion of existing project		60,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		60,000 00

———

Abstract of proposals for improving Raritan Bay, New Jersey, opened September 21, 1882, by Maj. G. L. Gillespie, Corps of Engineers.

No.	Names of bidders.	Price.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	Atlantic Dredging Company	$0 22	May 1, 1883	.....
2	Henry E. DuBois	26	Omitted.	.....
3	Chandler H. Loomis	24	(*)	.....
4	John W. & Daniel Ambrose, and Robert J. Mills	45	Omitted.	Omitted.

* 100 working days.

Contract awarded to Atlantic Dredging Company, the lowest responsible bidder, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

The following statistical information, for the fiscal year ending June 30, 1883, relative to the collection district of Perth Amboy, N. J., was furnished by Mr. John D. Martin, deputy collector at Perth Amboy, N. J.:

VESSELS CLEARED AND ENTERED DURING THE YRAR ENDING JUNE 30, 1883.

Entered.

	Number.	Tonnage.
Coastwise	159	38,619.34
American	0	0
Foreign	18	22,094.00

Cleared.

Coastwise	65	22,618.00
American	34	13,646.00
Foreign	25	8,110.00
Exports		$94,780 00
Imports for consumption		109,352 00
Imports for warehouse and rewarehouse		77,634 00
Duties collected		82,475 15

NUMBER AND TONNAGE OF VESSELS BELONGING TO AND DOCUMENTED AT PORT OF PERTH AMBOY, N. J.

	Number.	Tonnage.
Sailing	363	17,489.19
Steam	67	9,812.51
Barges	95	20,507.61
Canal-boats	139	15,218.72
Total	664	63,028.08

F 17.

IMPROVEMENT OF MATTAWAN CREEK, NEW JERSEY.

The project for this improvement was adopted in 1881, and provides for dredging a channel 100 feet wide and 4 feet deep, at mean low water, from the mouth to Winkson's Creek, and thence to head of navigation at Long Branch Railroad crossing, 75 feet wide, to the same depth.

The amount available July 1, 1882, was $155.09; the act of August 2, 1882, appropriating $6,000, making the total amount available during the past fiscal year $6,155.09. This was wholly applied in dredging. Sealed proposals, invited by public advertisement, were opened September 21, 1882, and the contract awarded to Frank Pidgeon, jr., the lowest responsible bidder, at 59 cents per cubic yard.

He began his contract November 13, 1882, and completed it May 14, 1883, having removed 8,897 cubic yards of mud and sand. The portion of the creek improved extends from the brick factory to the freight wharf near the railroad crossing, covering a river length of 2,500 feet. The original project called for the removal of 48,000 cubic yards; the removal of 13,473 cubic yards will complete the project. Estimating the cost of removal at 60 cents per cubic yard the total amount required for the completion of the improvement will be $9,000. The improved channel up to 600 feet above the brick factory has a width of 60 feet, but thence to the head of navigation it has only a width of 30 feet, except at Ellis's dock and freight wharf where the width has been made 60 feet for the convenience of vessels. The amount ($8,500) asked for will

be applied in completing the project by widening the channel near mouth of Winkson's Creek, and at the upper part near the head of navigation. The creek is now in good navigable condition, but the channel near the head of navigation is still too narrow for ease in handling vessels. The improvement has given great satisfaction to the farmers in the vicinity, who are now enabled to get their products out by water without paying excessive railroad rates.

The articles shipped from the several wharves consist of garden produce, brick, and lime, and the articles imported are lumber, iron ore, agricultural implements, assorted merchandise, lumber, and compost. The shipping of the creek is valued at $150,000 annually.

The work is in the collection district of Perth Amboy. Nearest port of entry, Perth Amboy. Nearest light-house, Prince's Bay. Fort at Sandy Hook is the nearest fort.

Amount of revenue collected at the port of Perth Amboy during the year ending June 30, 1883, ——.

Original estimate	$33,120
Amount expended to date, exclusive of outstanding liabilities	21,000
Amount appropriated from March 3, 1881, to August 2, 1882, both inclusive.	21,000

Money statement.

July 1, 1882, amount availabe	$155 09	
Amount appropriated by act passed August 2, 1882	6,000 00	
		6,155 09
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		6,155 09
Amount (estimated) required for completion of existing project		12,120 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		9,000 00

Abstract of proposals for improving Mattawan Creek, New Jersey, opened September 21, 1882, by Maj. G. L. Gillespie, Corps of Engineers.

No.	Names of bidders.	Price.	Date of commencement.	Date of completion.
		Per cu.yd.		
1	Frank Pidgeon, jr	$0 59	Omitted	Omitted
2	Frank C. Somers	68	Apr. 20, 1883	June 15, 1883
3	Elijah Brainard and Thomas H. Benton	71	Omitted	Omitted
4	John McDermott	69	....do.....	Dec. 30, 1882

The contract was awarded to Frank Pidgeon, jr., the lowest responsible bidder, with the approval of the Chief of Engineers.

F 18.

IMPROVEMENT OF KEYPORT HARBOR, NEW JERSEY.

The present project was adopted in 1873, and has for its object the opening of a channel from Keyport wharf to Raritan Bay 4,700 feet long, 200 feet wide, and 8 feet deep at mean low water, to enable the boats drawing 6 feet, which ply regularly between New York City and Keyport, to reach the town wharves at all stages of the tide instead of

being compelled to stop at low tide at the railroad wharf half a mile to the northward.

The act of August 2, 1882, appropriated $30,475 for the improvement. Sealed proposals, invited by public advertisement, were opened in this office September 21, 1882, and the contract awarded February 27, 1883, to the Atlantic Dredging Company, of Brooklyn, the lowest bidder, at 24 cents per cubic yard. Operations were commenced under the contract June 26, 1883, and are now in progress. Up to the close of the fiscal year 1,863 cubic yards have been removed.

This channel when improved, will add largely to the commercial importance of the port, which is situated on the south side of Raritan Bay, only 5½ miles east of South Amboy.

An examination of the channel was made in September, 1882, for the purpose of determining what changes, if any, had taken place since the survey of 1872. The results of the examination were that, while the direction of the channel had remained unchanged, there were unmistakable evidences of a uniform shoaling throughout, and this was the more marked between the railroad and city wharves, where deep water was most desirable.

It is estimated that an appropriation of $10,000 will be required for the removal of the shoalings occurring subsequent to 1872; and the additional appropriation for the amount asked for will be applied towards the completion of the project of 1873.

The work is in the collection district of Perth Amboy. Nearest light-house, Prince's Bay. Fort Sandy Hook is the nearest fort.

Amount of revenue collected at the port during the fiscal year ending June 30, 1883, ——

Original estimate (revised)	$40,475 00
Amount expended, exclusive of outstanding liabilities	356 65

Money statement.

Amount appropriated by act passed August 2, 1882		$30,475 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$356 65	
July 1, 1883, outstanding liabilities	447 12	
		803 77
July 1, 1883, amount available		29,671 23
Amount (estimated) required for completion of existing project		10,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		10,000 00

Abstract of proposals for improving Keyport Harbor, New Jersey, opened September 21, 1882, by Maj. G. L. Gillespie, Corps of Engineers.

No.	Name of bidders.	Price.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	John H. Fenner	$0 65	Omitted	June 30, 1883
2	Frank Pidgeon, jr	42 9/10	do	Omitted.
3	Elijah Brainard & Thomas H. Benton	38	Nov. 15, 1882	Aug. 31, 1883
4	Atlantic Dredging Company	24	June 1, 1883	Nov. 1, 1883
5	Frank C. Somers	57½	Mar. 15, 1883	June 10, 1883

Contract awarded to the Atlantic Dredging Company, the lowest responsible bidder, with the approval of the Chief of Engineers.

F 19.

REMOVING SUNKEN VESSELS OBSTRUCTING OR ENDANGERING NAVIGATION.

The iron steamer Nankin, which was wrecked in the Swash Channel at the entrance to New York Harbor April 28, 1882, was sold at public auction May 31 to Mr. William E. Chapman. On the 14th of June, under instructions from the Secretary of War, Mr. Chapman was directed to take steps for the removal of the wreck, as required by section 4 of the river and harbor act of June 14, 1880. At the expiration of the thirty days' notice the owner was informed that the wreck would be declared derelict unless he gave evidence that he was working in good faith to remove it as a whole, and not such parts only as were of value. He replied that he was working vigorously to wholly remove the wreck.

Early in August, fearing that the owner would not fulfill his promises, it was deemed best to advertise for proposals for the removal of the wreck. The proposals were opened September 14, 1882, but in view of the written protest of the owner, the reputed irresponsibility of the lowest bidder, and the absence from all proposals of a definite time within which the bidder proposed to effect the removal, it was recommended when the abstract of proposals was forwarded that no action be taken on the bids for sixty days.

When the winter opened the owner was still at work, but the results accomplished were insignificant. He was permitted, however, to continue at work unmolested until June 14, 1883, when he finally abandoned the wreck. Sealed proposals, a second time invited by public advertisement, were opened June 30, and the contract awarded to Edward McDonald for the sum of $27,000, time of removal being limited to June 30, 1884. He is making arrangements to commence work by July 18. The bidders before presenting their bids asked permission to include in their bids an offer for the purchase of the wreck, conditioned on the acceptance of their bid for removal. This was not in compliance with the act of August 2, 1882, enlarging the powers and authority of the Secretary of War, under section 4 of the act of June 14, 1880, relating to wrecks, &c., which says that the Secretary of War may "sell and dispose of any such sunken craft, vessel, or cargo, or property therein, before the raising or removal thereof, *according to the same regulations that are in the said act prescribed for the sale of the same after the removal thereof, and all laws and parts of laws inconsistent herewith are hereby repealed.*"

Now, the regulations of the previous act to which reference is here made are as follows:

> Such sunken vessel, or craft, and cargo and all property therein, when so removed shall, *after reasonable notice of the time and place of sale, be sold to the highest bidder or bidders for cash*, and the proceeds of such sale shall be deposited in the Treasury of the United States to the credit of a fund for the removal of such obstructions to navigation, &c.

The act of August 2, 1882, enlarged the powers of the Secretary of War only so far as related to the sale of the vessel *before removal*, and did not effect what was desired in the matter. Further, its result was to compel the Government to accept the *highest bid* for the sale and the *lowest bid* for removal. Such a procedure is impracticable in application. There is no object in a contractor bidding for the purchase of the vessel unless he is authorized to remove it. The two proposals must be taken together when determining the lowest bidder, and the price

bid for the purchase of the vessel must be allowed as an offset to the price bid for its removal. As the payment, under existing laws, for the removal of the wreck can only be made after the removal has been effected to the satisfaction of the officer in charge, a period covering, at times, as much as one year and probably more, it will be seen that the contractor is compelled to provide expensive plant and a large force of skilled labor, and to pay, without any advance to him from the Government, all the running expenses of his plant and force during the progress of his work. If the work is of great magnitude he will be required to incur an immense outlay, much beyond the means of the average contractor.

The effect of the law, then, is to rule out worthy men simply because their working capital is too small. The contractor wants the material as he removes it in order to utilize his force at those times when storms prevent economical labor upon the wreck and to make sale of it from time to time as it is removed to provide means for paying, in part, his running expenses.

I would recommend that the act of June 14, 1880, be changed to read as follows:

AN ACT making appropriation for the construction, repair, and preservation of certain works on rivers and harbors, and for other purposes.

SECTION —. Whenever hereafter the navigation of any river, lake, harbor, or bay, or other navigable water of the United States shall be obstructed or endangered by any sunken vessel or water craft, it shall be the duty of the Secretary of War, upon satisfactory information thereof, to cause reasonable notice, of not less than thirty days, to be given personally or by publication at least once a week in the newspaper published nearest the locality of such sunken vessel or craft to all persons interested in such vessel or craft, or in the cargo thereof, of the purpose of said Secretary, unless such vessel or craft shall be removed as soon thereafter as practicable by the parties interested therein, to cause the same to be removed.

If such sunken vessel or craft and cargo shall not be removed by the parties interested therein as soon as practicable after the date of the giving of such notice by publication, or after such personal service of notice as the case may be, such sunken vessel or craft shall be treated as abandoned and derelict, and the Secretary of War shall proceed to remove the same.

The Secretary of War shall then cause sealed proposals to be solicited by public advertisement as prescribed by law, to be opened after reasonable notice of time and place, for the removal, for a gross sum, of such sunken vessel, craft, and cargo, and property therein, conditioned that such vessel, craft, and cargo shall on removal become the property of the contractor, and the contract shall be awarded to the lowest responsible bidder, provided that he shall give satisfactory security to execute the work, under a forfeiture not exceeding double the contract price in case of failure. The provisions of this act shall apply to all such wrecks whether removed under this act or under any other act of Congress. Such sum of money as may be necessary to execute this section of this act is hereby appropriated out of any money in the Treasury of the United States not otherwise appropriated, to be paid out on the requisition of the Secretary of War.

Money statement.

July 1, 1882, amount available from allotment of June 14, 1880		$8,336 88
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882.....	$139 17	
July 1, 1883, outstanding liabilities.....	35 90	
	———	175 07
July 1, 1883, amount available.....		8,161 81

Abstract of proposals for removal of the wreck of the iron steamer Nankin, now lying in the Swash Channel at the entrance to New York Harbor, opened September 14, 1882, *by Maj. G. L. Gillespie, Corps of Engineers.*

No.	Names of bidders.	Prices.
1	Samuel R. Cumming	$24,749 00
2	George W. Townsend	*32,000 00
3	Hugh McDonald	29,000 00
4	William E. Chapman & Matthew H. Gregory	49,000 00

* Or $10,000, bidder to keep material.

The recommendation that "no action be taken on the lowest bid for sixty days" was approved by the Secretary of War, September 29, 1882.

Abstract of proposals for the removal of the iron steamer Nankin, now lying in the Swash Channel at the entrance to New York Harbor, opened June 30, 1883, *by Maj. G. L. Gillespie, Corps of Engineers.*

No.	Names of bidders.	Removal of wreck.	Purchase of wreck.	Net cost of removal.
1	Samuel R. Cumming	$29,974 00	$6,000 00	$23,974 00
2	Edward R. Lowe	53,961 00	*Per ton, $7 50	42,711 00
3	George W. Townsend	38,000 00	$19,000 00	19,000 00
4	I. J. Merritt	40,000 00	15,000 00	25,000 00
5	Edward McDonald	27,000 00	5,000 00	22,000 00

* Estimated at $11,250 for wreck.

Contract awarded to Mr. Edward McDonald, the lowest responsible bidder, subject to the approval of the Chief of Engineers.

APPENDIX G.

IMPROVEMENT OF DELAWARE AND SCHUYLKILL RIVERS AND NORTH BRANCH OF THE SUSQUEHANNA—OF RIVERS IN NEW JERSEY AND DELAWARE—HARBOR IMPROVEMENTS IN DELAWARE RIVER AND BAY—CONSTRUCTION OF PIER AT LEWES—DELAWARE BREAKWATER.

REPORT OF LIEUTENANT-COLONEL G. WEITZEL, CORPS OF ENGINEERS, BVT. MAJ. GEN., U. S. A., OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1883, *WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

1. Delaware River, between Trenton, N. J., and Bridesburg, Pa.
2. Delaware River, below Bridesburg, Pa.
3. Delaware River, at Schooner Ledge.
4. Delaware River, near Cherry Island Flats.
5. Frankford Creek, Pennsylvania.
6. Schuylkill River, Pennsylvania.
7. Ice Harbor at Marcus Hook, Pennsylvania.
8. Ice Harbor at Chester, Pa.
9. Ice Harbor at New Castle, Del.
10. Ice Harbor at the head of Delaware Bay.
11. Wilmington Harbor, Delaware.
12. Broadkiln River, Delaware.
13. Mispillion Creek, Delaware.
14. Duck Creek, Delaware.
15. Cohansey Creek, New Jersey.
16. Salem River, New Jersey.
17. Chester Creek, Pennsylvania.
18. Rancocas River, New Jersey.
19. Saint Jones River, Delaware.
20. Maurice River, New Jersey.
21. Mantua Creek, New Jersey.
22. Woodbury Creek, New Jersey.
23. Raccoon River, New Jersey.
24. Indian River, Del.
25. North Branch of Susquehanna River, Pennsylvania.
26. Construction of iron pier in Delaware Bay, near Lewes, Delaware.
27. Delaware Breakwater Harbor, Delaware.
28. Removal of wrecks from Delaware Breakwater Harbor, Bay, and River.
29. Removing sunken vessels obstructing or endangering navigation.
30. Port Warden's Lines, Philadelphia, Pa.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., July 27, 1883.

SIR: I have the honor to submit herewith the annual reports of the works for river and harbor improvements and the examinations and surveys in my charge for the fiscal year ending June 30, 1883.

Until August 12, 1882, Maj. William Ludlow, Corps of Engineers, U. S. Army, had charge of these works.

Very respectfully, your obedient servant,

G. WEITZEL,
Lieut. Col. of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

G 1.

IMPROVEMENT OF THE DELAWARE RIVER BETWEEN TRENTON, NEW JERSEY, AND BRIDGESBURG, PENNSYLVANIA.

The river and harbor act which passed August 2, 1882, made an appropriation of $10,000 for this work.

During the past fiscal year operations have been carried on under the project approved September, 1878.

This improvement is of the highest importance to the numerous vessels that pass up to Trenton and the very large inland traffic through the Delaware and Raritan Canal. It was begun near Bordentown, N. J., where the greatest obstructions existed, and thus far has been a success.

After the improvements at or near this point are completed, other points on this portion of the river will need attention. It is proposed to begin next at Kincora Bar about 2½ miles below.

The sum of $35,000 should be appropriated for the fiscal year ending June 30, 1885.

The annexed copy of the report of the assistant, Mr. A. Stierle, in local charge of the work, gives fuller details of the operations of the past fiscal year, as well as the commercial statistics.

This work is in the collection district of Burlington, N. J., which is the nearest port of entry.

Fort Mifflin is the nearest fort and the Horseshoe range lights the nearest lighthouses.

Total appropriations to June 30, 1883	$91,000 00
Total expenditures to June 30, 1883	88,174 44

Money statement.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$6,724 28	
July 1, 1883, outstanding liabilities	450 16	
		7,174 44
July 1, 1883, amount available		2,825 56
Amount (estimated) required for completion of existing project		75,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		35,000 00

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on October 9, 1882, for dredging in the Delaware River, near Bordentown, N. J.

No.	Names and addresses of bidders.	Dredging.	To commence.	To complete.
		Per cu. yd.		
1	Frank C. Somers, Philadelphia, Pa	$0 53	May 1, 1883	June 30, 1883
2	Jas. Caler & Son, Baltimore, Md	53	Not given.	Not given.
3	M. Herron, Bordentown, N. J	40	Oct. 19, 1882	May 1, 1883

Contract awarded to Michael Herron; dated October 28, 1882; to be completed May 1, 1883.

REPORT OF MR. A. STIERLE, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., July 1, 18-3.

SIR: I have the honor to submit the following report upon the improvement of Delaware River between Trenton, N. J., and Bridesburg, Pa., for the fiscal year ending June 30, 1883:

The river and harbor act of August 2, 1882, appropriated $10,000 for this improvement. This amount, which, on an average, is annually appropriated, is comparatively small, considering the extent of this section of the river with a much frequented water-way 28 miles in length. A number of obstructions exist therein, and have been

pointed out as requiring improving, but it has heretofore been impossible to make improvements at any other than one and the same point.

With the appropriations heretofore made, the improvement of the navigation of the Delaware River in the immediate vicinity of Bordentown, N. J., has been carried on. The results and the progress made yearly are to be found in the Annual Reports for 1878, 1879, 1880, 1881, and 1882. The appropriation of August 2, 1882, was to be expended at the same place to continue the improvements as originally projected.

As stated in the last Annual Report, it was found necessary, in order to relieve the pressure of the water, during freshets upon the dikes, which have been built between Duck Island and Long Bar and between Long Bar and the mainland, respectively, to remove some of the top courses of logs from the middle section of each dike. This plan was carried out before the close of the last fiscal year, in the case of the upper dike between Long Bar and the mainland, with the small balance of money then on hand. As soon as the appropriation of August 2, 1882, became available similar repairs were made to the lower dike between Duck Island and Long Bar; in addition to which both dikes were covered with a decking of 3-inch hemlock planks, the embankments were rebuilt, and the washouts around the ends were filled in with stone and gravel. These repairs were made during the month of October, 1882, at a cost of $1,100, no damage having been done to the dikes since by freshets.

It was proposed to expend the balance of the appropriation in dredging in the east channel of the Delaware River below Duck Island by widening the cut made the previous year across the bar to 150 feet. In response to advertisements published in September inviting proposals, three bids were received, and the contract was soon thereafter awarded to Mr. M. Herron, of Bordentown, N. J.; 40 cents per cubic yard was the price to be paid for dredging.

Dredging operations commenced October 26, 1882, and continued until November 28, 1882, when ice began to form and it became necessary to remove the dredging-machines to safe harbor.

The lateness of the annual spring freshets this year made it impossible to resume dredging as early as was expected. Nearly the whole expanse of the river in the vicinity of Bordentown is, after the occurrence of the freshets and far into the summer, covered by rafts from the upper sections of the Delaware which are taken from here to different markets. On account of these obstructions it was not until June 27 that the contractor was again enabled to resume operations.

The total amount of material removed from the channel during the last fiscal year is 11,428 cubic yards, leaving a balance of about 6,000 cubic yards to be removed during the present fiscal year before the contract is completed.

The channel as far as dredged has shown an unexpected permanency and will perhaps retain the same without the adjunct of a deflecting dike on the Pennsylvania shore, which was thought to be necessary when this improvement was first under consideration. There is, however, great injury being done, indirectly, to the improvements as now carried on by the removal of thousands of cubic yards of sand annually from the western channel of the river just opposite the channel dredged by the United States by parties who dredge the sand for building purposes.

This channel leads to the entrance of the Delaware and Raritan Canal, thence upward to deep water abreast of Duck Island, and will ultimately become an important link in connection with the navigation, extending up the Delaware to Trenton. Its maintenance when once established is therefore important.

It has been observed that near the lower junction of the western and eastern channels, about one-half mile above White Hill, the latter has contracted considerably since dredging operations ceased at that point in 1879. The long tows of boats and barges going to and coming from the Delaware and Raritan Canal follow its narrow and tortuous course with difficulty, especially during prevailing northwesterly winds. The widening of the channel here is absolutely necessary.

The balance of the appropriation made August 2, 1882, will be expended at the end of the present fiscal year.

For the fiscal year ending June 30, 1885, the following appropriations are required and recommended:

1. Continuing improvement in East Channel, near Bordentown, N. J	$20,000
2. Beginning improvement at Kincora Bar	15,000
Total	35,000

This improvement is in the collection district of Burlington, N. J., which is the nearest port of entry.

Fort Mifflin is the nearest fort, and the Horseshoe range lights the nearest lighthouses.

Very respectfully, your obedient servant,

A. STIERLE,
Assistant Engineer.

Lieut. Col. G. WEITZEL,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

The firm of S. & J. M. Flanagan, Philadelphia, state that during the past year they have towed up the Delaware River to Bordentown, N. J., an aggregate of 14,626 boats, which carried 965,504 tons of miscellaneous freight, such as coal, bricks, grain, iron, stone, sand, lime, clay, paper, salt, and lumber.

The Delaware and Raritan Canal Company give the tonnage passing through their canal, both ways, at Bordentown, N. J., during its season of 1882, as 1,258,837 gross tons on 7,942 loaded boats and 384 lumber rafts, and during the same time 3,568 boats passed through light. Their collector at Bordentown estimates the tonnage to and from that point not entering the canal, at 85,000 gross tons.

G 2.

IMPROVEMENT OF THE DELAWARE RIVER BELOW BRIDESBURG, PENNSYLVANIA.

In the last annual report on this improvement my predecessor, Maj. William Ludlow, Corps of Engineers, U. S. Army, says:

The improvement of the Delaware River navigation has now so far advanced in consequence of operations at several points and of the surveys which, as elsewhere reported, have been completed from Bridesburg to Liston's, a distance of 57 miles, as to have developed the location and character of all the obstructions existing and requiring present attention.

It may be said with regard to the general subject that over very few stretches of the main channel are the depths or widths greatly in excess of those needed for purposes of free navigation for the Delaware commerce, which includes the heavest class of vessels engaged in foreign trade, and that for long distances, even where no obstructions exist, the capacity is only just sufficient for that commerce. For this reason the system of landing the dredgings in such manner as to prevent their return to the river, to be redistributed by the alternating currents, has now been adopted since 1880, in accordance with the recommendations from this office, confirmed by the report of a Board of Engineers and approved by the Chief of Engineers.

The immediate result was an increase in the cost of dredging, but as the contractors sought for and found opportunities to fill lands and derive a profit therefrom, the cost of dredging fell again to what it had been under the former system of throwing the spoil into the river.

This states the case correctly, in my opinion.

Whether this portion of the Delaware River is ever permanently improved by works of construction, or whether the policy in the future will be to keep open the cuts which are now in process of construction, the existing project of making these cuts at the several points now in hand must first be executed.

The points on this portion of the river at which the important obstructions exist are as follows:

1. Near Five-Mile Point, between Bridesburg and Philadelphia.
2. The vicinity of Petty's Island, Philadelphia.
3. The bars between Philadelphia and Camden.
4. A shoal near Greenwich, Philadelphia.
5. The "Horseshoe," between Philadelphia and League Island.
6. Mifflin Bar, 3 to 4 miles below League Island.
7. Schooner Ledge, between Chester and Marcus Hook.
8. The Cherry Island Flats, opposite Wilmington.
9. Bulkhead Shoals, between New Castle, Del., and Pea Patch Island.
10. Dan Baker Shoals, near the head of Delaware Bay, between Reedy Island and Liston's Point.

In the case of Schooner Ledge and the Cherry Island Flats, the river

and harbor acts made specific appropriations, which are not included in the general appropriation for the Delaware River, and are separately reported upon elsewhere.

The sum of $136,000 was appropriated by the river and harbor act which passed August 2, 1882, for this portion of the river, of which $11,000 was to be expended for the improvement of Smith's Island Bar. The remaining $125,000 were allotted as follows:

For continuing the construction of the up-river channel past the upper end of Petty's Island	$4,500
For widening the main ship-channel past Petty's Island	25,000
For continuing operations at Mifflin Bar	40,000
For continuing operations at Bulkhead Shoals	55,500
Total	125,000

FIVE-MILE POINT.

The obstructions here affect the up-river trade since the main ship-channel and the export business of Philadelphia terminate below.

This up-river trade is, however, quite extensive. Numerous vessels ply to Trenton and intermediate points, and the inland commerce by the Delaware and Raritan Canal between New York and Philadelphia passes this point.

It will be a matter of great expense and difficulty to obtain a channel under Five-Mile Point sufficiently deep to meet the requirements of this up-river commerce. Hence relief has been sought and found elsewhere. During December, 1881, and January, 1882, a channel was begun past the upper end of Petty's Island, and this channel was widened to 200 feet, with an allotment of $4,500 from the general appropriation for the improvement of the Delaware River below Bridesburg.

This channel should be deepened to 12 feet at mean low water, and an appropriation or allotment of $5,000 should be made for this purpose.

PETTY'S ISLAND BAR.

The improvement at this point has been in progress since 1879. It has for its object the removal of this bar, which separates the main ship-channel from a stretch of 1½ miles of deep water lying off the upper section of the city.

During the past fiscal year the operations have continued in accordance with the approved project for the work. To the end of the fiscal year 7,516 cubic yards of material had been removed. This material consists mainly of cobble-stones and coarse gravel, and as it must all be landed it makes the dredging quite expensive.

This improvement is of the very highest importance. The extension of the main ship-channel abreast of Port Richmond is of vital importance to the development of the upper portion of the port of Philadelphia. This section has been growing steadily, and its commerce has steadily increased. The Reading Railroad Company have made and are making large improvements in their terminal facilities here. A great many improvements have been made by others, and are still being made, to develop the foreign commerce of this part of the city.

The sum of $50,000 should be appropriated or allotted to continue this work.

I annex hereto the report of Mr. A. Stierle, the assistant in local

charge of the works at this point and at the head of Petty's Island, which is as follows:

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., July 1, 1883.

SIR: I have the honor to submit herewith the annual report for the fiscal year ending June 30, 1883, upon the improvement of the Delaware River near Petty's Island.

This improvement has been carried on since 1879 under the general appropriations made for the Delaware River below Bridesburg, Pa.

Since 1881 it has consisted of two distinct works, situated near each other; one, the dredging of a small channel at the upper end of Petty's Island for the benefit of the up-river traffic; the other, the extension of the main ship-channel abreast of Port Richmond, across a shallow bulkhead to a deep-water pocket 1½ miles long, lying off the upper part of the city of Philadelphia.

The channel first referred to connects the 9-foot curves opposite Five-Mile Point and abreast of Petty's Island, respectively, and was projected to facilitate up-river navigation and to avoid the old and crooked channel around Five-Mile Point. Its construction was commenced in 1881, with an allotment of $3,000 from the general appropriation, and at the close of dredging operations, January, 1882, when this amount had been expended, a clear channel width of 70 feet, with a depth of 9 feet, had been obtained.

From the general appropriation for the Delaware River below Bridesburg, of August 2, 1882, the further sum of $4,500 was allotted for widening the channel to 200 feet. Contract was made soon thereafter with the American Dredging Company of Philadelphia, who commenced operations October 20, 1882, and completed the contract by December 8, 1882, during which time 11,566 cubic yards of material were removed. The width of the cut had been increased from 70 to 200 feet, and although no examination has been made since that time there are no apparent indications of much, if any, filling-in taking place. This, in a measure, is prevented also by the scouring effects of numerous steamers passing through this channel, preferring it to the older one around Five-Mile Point.

The opening-up of this cut has an important bearing upon the currents of the river. It is, in one sense, a valuable adjunct to the improvements carried on near the lower end of Petty's Island, since it cuts off materially the force of the ebb tide running back of the island, inducing the same to follow, in an easy and uninterrupted curve, the natural direction of the stream and currents on the Pennsylvania side. In the contemplated improvements at the head of Petty's Island and at Fisher's Point, which have inferentially been mentioned in previous reports, as eventually necessary for the regulation of the Delaware River, this cut will form the basis for the main channel at this point, following, as it does, the concave side of the bend in the river.

It is proposed to deepen this channel to 12 feet at mean low water, to allow vessels of deeper draught to pass through at every stage of the tide. The large side-wheel steamers, towing the heavy tows up the Delaware, are still obliged to use the channel back of Petty's Island during low tide, at a great loss of time and expense. During the fiscal year of 1884–'85 the sum of not less than $5,000 can be profitably expended for this purpose.

The second point to be improved under the allotment made for the Delaware River "near Petty's Island" is, as stated above, the extension up the river of the main ship-channel. This work has been in progress since 1879; the area dredged over, however, is comparatively small, owing to the deep cut to be made—24 feet at low water—and the high contract prices paid for the removal of material of the coarsest kind. Nevertheless, the results accomplished have been of the greatest benefit to the coasting and foreign shipping centering at Port Richmond.

The sum of $25,000 was allotted from the general appropriation for the Delaware River below Bridesburg, Pa., made by river and harbor act which passed August 2, 1882. This amount was proposed to be expended in widening the channel, especially near the upper end. The contract was let, after the usual preliminary steps had been taken, to the New York Steam Dredging Company, of New York City, at the price of 54½ cents for each cubic yard of material removed. Owing to the lateness of the season, operations were deferred until spring.

On May 3 of this year dredging commenced, and has since been carried on with fair progress. At the end of the fiscal year 7,516 cubic yards of coarse gravel and cobblestones had been removed, of which the greater portion was landed behind the bulkhead at the upper end of Petty's Island, the remainder being used in filling in wharves.

The completion of the contract has been extended from July 1 to December 1, 1883, by which time it is supposed the total estimated quantity of 40,000 cubic yards will have been removed.

The development in commercial importance of this section of the port of Philadelphia has been steadily growing of late years, and must continue to do so with the great facilities to navigation offered to all classes of vessels by the improvements

made by the United States. The number and tonnage of foreign vessels visiting thi point particularly has been augmented. The terminal improvements constructed by the Reading Railroad Company along the water front at Port Richmond are planned upon the largest scale, and are being continually extended, creating shipping facilities for the largest class of vessels. During the past year the largest dock in the port of Philadelphia was constructed here by this company. Other improvements, designed for a still greater development of foreign trade, are in contemplation, which apart from their local importance must materially contribute towards an increase in the revenues collected in the port of Philadelphia.

It is proposed to continue the improvement as originally planned by extending the channel to deep water above, and to dredge the same sufficiently wide that the larger class of vessels may find no difficulty in entering and leaving the docks. No less than $50,000 should be appropriated for the fiscal year 1884–'85 to continue this work.

Very respectfully, your obedient servant,

A. STIERLE,
Assistant Engineer.

Lieut. Col. G. WEITZEL,
Corps of Engineers, U. S. A.

SMITH'S ISLAND BAR.

During the past fiscal year nothing has been done here except to make a survey of the river.

My predecessor, on page 731 of the Report of the Chief of Engineers for 1882, states all that I can say on this subject.

During the past year, however, the channel which was excavated from Camden towards Shackamaxon street, Philadelphia, in 1880 and 1881, has badly filled up.

Mr. A. Stierle, the assistant in local charge, gives further details in his annual report, which is as follows:

PHILADELPHIA, PA., *July* 1, 1883.

SIR: I have the honor to submit, for the fiscal year ending June 30, 1883, the following report on Smith's Island Bar, one of the several points included in the general improvement of the Delaware River below Bridesburg, Pa.

The amount allotted for this bar from the general appropriation passed August 2, 1882, for the Delaware River below Bridesburg, was $11,000. The river and harbor act of the same date provided also for a "survey in front of Philadelphia by removal of Windmill or Smith's Island or the bar above the same."

In the project for the expenditure of this money subsequently submitted to the Department, it was proposed to use a portion of this sum to defray the expenses of the survey, the balance to remain unexpended until a general report and project, based upon the proposed survey, had been submitted. This project was approved and the survey has been in progress since last fall under the immediate charge of Mr. E. A. Gieseler, assistant engineer.

It is proposed during the present fiscal year, after the completion of the survey, to make plans and estimates for the general improvement of the bar, and if these are approved to begin the improvements with the balance of the money.

During the fiscal year ending June 30, 1885, $25,000 can be profitably expended at this point.

Very respectfully, your obedient servant,

A. STIERLE,
Assistant Engineer.

Lieut. Col. G. WEITZEL,
Corps of Engineers, U. S. A.

SHOAL NEAR GREENWICH.

Nothing has been done at this point during the past fiscal year, it being more important to spend the money elsewhere.

THE HORSESHOE.

The following, which my predecessor says on this subject in the last Annual Report, is all that I am now prepared to say:

In passing the lower part of Philadelphia, between Gloucester, N. J., and League Island, the river describes a long curve of nearly ninety degrees, and is bordered on

both banks by extensive shoals. On these, and especially upon the concave New Jersey shore, the ice in winter accumulates, gorging on both tides, by reason of the grounding of the ice and the constrictions in width above and below the Horseshoe.

The city ice-boats during severe winters are engaged in part in keeping an open channel through the ice-fields, but the task is one of much difficulty and their efforts sometimes unavailing, by reason of the jamming of the floating ice against the ground ice and the consequent cessation of movement.

Since the presence of ice in the river during and subsequent to the prevalence of low temperatures cannot be prevented, it can only be gotten rid of by keeping it in motion during the continuance of the ebb current, and so gradually free the harbor by passing the ice down-stream in successive stages. To break the jam on the flood, unless when essential for the inward passage of a vessel, defeats the object, and only sends the ice upward to add to the difficulty on the subsequent ebb. The masses of ice in the "Shoe" are occasionally so heavy that the ice-boats are ineffective, and motion ceases for hours.

A dike or bulkhead from Gloucester to near Eagle Point, somewhat flattening the curve of the river, and following approximately the 12 or 15 foot curve on the concave side, would be an efficient means of keeping the ice in motion, as its smooth surface would afford no hold for the floating ice, and the depth of water would prevent grounding.

Whatever works of this kind may be hereafter adopted, the expense in any case will be considerable. It is probable, however, that as the business of the port increases, renewed attention will be given to the disadvantages of the Horseshoe navigation.

MIFFLIN BAR.

The description of this improvement and its history are given in previous annual reports. It does not, therefore, seem necessary to repeat them here.

The report, as given below, of Mr. Thomas Valentine, the assistant in local charge, gives the history of operations during the past fiscal year, and I agree with his statement as to the importance of removing the old Fort Mifflin light-house pier.

I think, however, that the sum of $50,000 at least should be appropriated or allotted to continue this work in an economical manner.

PHILADELPHIA, PA., *July* 16, 1883.

SIR: I have the honor to submit the following report of operations for improving Delaware River below Bridesburg, Pa., at *Mifflin Bar Channel*, for the fiscal year ending June 30, 1883:

The site of this improvement is on the Delaware River, about 9 miles below the city of Philadelphia, and is known as Mifflin Bar Channel.

The object of the improvement is to connect the deep-water area above with that below the bar, and to enable vessels of the deepest draught to arrive at, and depart from, the port at any stage of the tide without being subjected to annoyance and delay at this locality. With this object in view, dredging operations have been in progress each season, with but slight interruption, since 1873.

During the past year dredging operations were in progress from August until December 1, under two contracts with the National Dredging Company of Washington, D. C., dated, respectively, December 22, 1881, and June 16, 1882, mostly upon the west side of the axis (one cut only being made upon the east side), so as to afford 26 feet depth of water at mean low tide.

The amount of material removed was 135,194 cubic yards, which was transported in scows to the Pennsylvania shore, deposited in a basin, and subsequently redredged into cars and taken inland and placed above high water.

The result of dredging operations was the construction of a channel 26 feet in depth and 210 feet in width, from the New Jersey channel on the south, through the bar, to the Pennsylvania channel on the north.

Under an allotment of $40,000 from the general Delaware River appropriation of $136,000 in the act passed August 2, 1882, advertisements were issued September 12, 1882, inviting proposals for the construction by dredging of the channel through Mifflin Bar, and in response thereto bids were received and opened October 14, 1882. The work was awarded to, and a contract entered into with, the New York Steam Dredging Company, under date of November 6, 1882.

No work was done during the year under this contract. The contractors were engaged, however, in making provision for the disposition of the dredged material by the construction of a bulkhead of timber near the Pennsylvania shore abreast of the

proposed channel work, thereby forming a receptacle for the channel material as provided in the contract.

During the present season it is proposed to commence and complete the dredging at this locality under the existing contract by the removal of about 95,000 cubic yards of material, and to increase the width of the existing channel to 350 feet.

Although favorable results have been attained by dredging at this channel, it is evident from its direction through the bar, which is about 20 degrees from parallel with the currents, that to maintain a 26-foot depth of channel and a width to meet the requirements of commerce, in the absence of any permanent works to augment the scour of flood and ebb currents, a certain amount of dredging must be done annually at this locality.

In connection with this improvement, I would recommend the removal of a detached pier in mid-river, opposite Fort Mifflin, formerly the site of Fort Mifflin light-house. It has been abandoned by the Light-House Establishment for nearly two years, and its removal would, no doubt, prove beneficial to the Mifflin Bar cut.

For the continuance of this improvement after the completion of the work under the present contract, an appropriation of $25,000 is asked.

This work is in the collection district of Philadelphia, at which, as a port of entry, there was collected during the past fiscal year revenue to the amount of $12,251,310.52.

The nearest fort and light-houses are, respectively, Fort Mifflin and Tinicum Island and Fort Mifflin Bar Cut range light-houses.

Very respectfully, your obedient servant,

THOS. VALENTINE,
Assistant.

Lieut. Col. G. WEITZEL,
Corps of Engineers, U. S. A.

BULKHEAD SHOALS.

The description of this work and its history during the past fiscal year are fully given in the report, as given below, of Mr. John J. Lee, the assistant, in local charge.

I concur in his recommendations that the sum of $62,000 should be appropriated or allotted to complete it.

FORT DELAWARE, DEL., *June* 30, 1883.

COLONEL: I respectfully submit the following report on the improvement of the channel at Bulkhead Shoals, Delaware River, for the year ending June 30, 1883.

The Bulkhead Shoal extends from Pea Patch Island in a northerly direction for a little more than 3 miles. The main ship-channel passes on the eastern or New Jersey side, turning sharply to the northeast about 2 miles above the island, and is marked by two sets of range-lights. The obstruction to navigation occurs above the bend on the range of the Deep-Water Point lights; the channel depth here diminishing to from 19 to 22 feet at low water for a distance of about half a mile.

The project of improvement is to dredge the channel to a clear depth of 24 feet at low water for a width of 600 feet.

Under a contract made in December, 1881, work was commenced in May, 1882, and at the close of the fiscal year ending June 30, 1882, 38,000 cubic yards of material had been removed. From July 1 to September 6, 1882, when work ceased, 48,000 cubic yards more were excavated, making a total of 86,000 cubic yards, all of which was deposited upon Pea Patch Island.

Of the appropriation of $136,000 in the act of August 2, 1882, for the "improvement of Delaware River below Bridesburg, Pa.," $55,500 were allotted for the continuance of this work. A contract with the Delaware and Chesapeake Improvement Company was entered into November 13, 1882, under which work was commenced in the construction of a bulkhead at Finn's Point, behind which the dredged material is to be deposited. Dredging was commenced on the shoal June 6, and the amount taken out to the 30th was 19,119 cubic yards.

Five cuts, each 35 feet wide, have been dredged through the shoal, thus forming a channel 24 feet deep at low water and 175 feet wide. It is proposed during the present season to increase the width to 385 feet.

To complete the project by increasing the width of the channel to 600 feet will then require the removal of 140,000 cubic yards of material, at an estimated cost as follows:

140,000 cubic yards, at 40 cents	$56,000
Inspection and contingencies	6,000
Total	62,000

The commerce to be benefited by this improvement is the whole of the deep-draught navigation of the Delaware River.

Amounts allotted to this work from the general appropriations for the "improvement of the Delaware River below Bridesburg, Pa.," have been as follows:

From appropriation of June 14, 1880	$10,000
From appropriation of March 3, 1881	32,000
From appropriation of August 2, 1882	55,500
Total allotments	97,500
Amount required to complete project	62,000
Amount that can be profitably expended in year ending June 30, 1885	62,000

Very respectfully, your obedient servant,

JOHN J. LEE,
Assistant Engineer.

Lieut. Col. G. WEITZEL,
Corps of Engineers, U. S. A.

DAN BAKER SHOALS.

Nothing has been done towards improving this point during the past fiscal year. During January last I directed the assistant in local charge of the subdistrict in which this obstruction lies to make me as full a report on the subject as the material on hand would permit.

I give below a copy of his report, and I have only to add that I approve his recommendations that the channel which he designates "No. 2" be improved.

The sum of $50,000 should be appropriated for this improvement for the fiscal year ending June 30, 1885.

FORT DELAWARE, DEL.,
March 1, 1883.

COLONEL: In accordance with your instructions of January 10 I have the honor to submit the following report on the proposed improvement of the Delaware River at "Dan Baker Shoal."

This shoal is about 48 miles from Philadelphia, and lies in the bend of the river below Reedy Island, extending, in connection with the "Stony Point Shoal," about 1½ miles out from the eastern or New Jersey shore.

The main ship-channel passes to the westward, making here a change of direction of about 47 degrees.

It is in this bend or elbow that the obstruction to navigation occurs, being caused by a bar extending from the shoal entirely across the channel, on which the depth at mean low water varies from 19 to 23 feet, while on the course followed by vessels it does not exceed 20 feet for a considerable distance. In consequence, all vessels of more than that draught arriving here near the low water are obliged to wait sometimes for eight or ten hours. Notably is this the case with the large outward-bound steamers from Philadelphia, which are frequently compelled to anchor above this obstruction until the rising tide enables them to pass.

The width of the channel opposite the Dan Baker Shoal, between the 20-foot curves on either side, is about 1 mile; the distance between the unobstructed channel of 24 feet above the bar and the same depth of water below is about 2¾ miles.

Over most of the area thus inclosed the soundings vary from 19.5 to 23 feet. On the line of deepest water, however, which runs nearer the eastern side of the channel, there are irregular reaches of 24 and 25 feet depth, interrupted by bars having over them 22 and 23 feet. The combined width of these bars is about 1,800 yards.

The sailing courses of this part of the river are marked by two sets of range-lights. These ranges conform to the general direction of the channel above and below the bend, and consequently do not correspond at this point with the line of deepest water, but pass mostly to the westward of it, intersecting in 21 feet of water and having for some distance not more than 20 feet.

The character of the bottom in the channel varies from "soft mud" to "hard," the "hard" being probably a combination of fine sand and clay, as at Bulkhead Shoals.

The depths given above are in all cases referred to mean low water. The rise and fall of the tide is about 6 feet.

Although the inconvenience of this obstruction has been felt for many years, since the introduction of vessels of greater size and draught the more pressing need for the removal of obstacles in the channel further up the river has prevented any efforts for its improvement.

In the report of Colonel Macomb for 1879 this shoal is alluded to as "being the sub-

ject of considerable complaint on account of the insufficient draught and narrowness and too rapid change of direction in the channel."

In 1880 this locality was included in the generai "survey of Delaware River," under the act of June 14, 1880, and in his report for 1881 Colonel Macomb recommends an appropriation of $50,000 for "beginning operations."

In the report for 1882 Captain Ludlow estimates the total cost of "connecting the 24-foot curves above and below the shoal" with a channel 300 yards wide to be $200,000.

No appropriation has been made especially for this work, and the general appropriations for the "improvement of Delaware River below Bridesburg" have so far been applied to points above.

The plan of improvement to be applied to this obstruction to navigation consists, evidently, in cutting through it a dredged channel of suitable width and a depth of not less than 24 feet at mean low water. The only question to be considered is the most advantageous location of this channel.

On the accompanying tracing from the survey made in 1880, to which I respectfully call your attention, I have indicated three proposed positions for a channel 900 feet in width, as follows:

No. 1. This location is designated by full orange lines. It connects the 24-foot curves above and below the bar at their nearest approach to each other, follows the general line of deepest water, and passes through the deep stretch in the middle of the bar, making a slight change of direction near the can-buoy. The dredging required would be at the upper and lower ends of the channel for a distance of about 3,400 feet in each case, or 6,800 feet in all. The quantity to be excavated, calculating the cut to be a depth of 25 feet at mean low water, would be about 466,000 cubic yards.

Not being on the lines of the established ranges, this channel would be comparatively useless at night, without additional lights.

No. 2. This position has the same starting points as the preceding, but differs from it in being in a direct line from one end to the other. By avoiding the change of direction in the middle, it offers greater facilities for marking its course either by lights or buoys. By means of two small beacon lights on Reedy Island, this channel could be followed from one of the main ranges to the other with perfect safety by day or night. The proposed limits are shown on the chart by broken orange lines.

The quantity of material to be excavated will exceed but little that of No. 1, and this will be balanced by the greater ease of working on one line instead of two. Only half the number of range signals for dredging will be required, and as these will necessarily be expensive on account of their distance from the work (Reedy Island being the nearest available place for them) this saving would be considerable.

No current observations for this locality are available, but their direction cannot vary much from that of the proposed channel, which would insure for it a good degree of permanency.

No. 3. This is marked on the tracing by broken lines and dots (—— . —— . ——) and follows the lines of the two light-house ranges which intersect it on the bar, extending 450 feet on either side of them. It would require continuous dredging for about 3 miles, with the exception of a few places where the deep water extends within its limits on one side or the other. The quantity of material to be excavated would be 1,362,000 cubic yards.

The sole advantage of this location is its correspondence with the sailing courses marked by the range-lights. The disadvantages are the abrupt change of direction at the intersection and the large amount of dredging required, which is three times that of either of the others.

In view of the considerations presented above, my opinion is decidedly in favor of the plan for a straight channel, indicated as No. 2 on the chart, as the most favorable location for the proposed improvement.

The estimates of cost are as follows:

Nos. 1 and 2 (practically the same for each): Excavating 466,000 cubic yards, at 40 cents	$186,400
Contingencies	18,600
	205,000
No. 3: Excavating 1,362,000 cubic yards, at 40 cents	544,800
Contingencies	55,200
	600,000

I have put the price at 40 cents per cubic yard in view of the exposed character and rough water of this locality, but it is very possible that contracts could be made for less. Especially would this be the case if the dredged material can be deposited

directly from the scows, without redredging or being confined by bulkheads, and it is supposed this can be done on the extensive flats between Appoquinimink Creek and Saint Augustine, without detriment to the navigation of the river.

In such cases as Bulkhead Shoals, the expense of rehandling and putting the material "above high water" is equal to one-half the whole cost.

In this case, owing to the greater difficulty of the first dredging, the proportion would not be so large, but it would probably amount to one-third, and if the material can be properly disposed of by simple dumping, at least 50 per cent. will be added to the quantity excavated.

The commerce to be benefited by this improvement will be all the navigation of the Delaware River having a draught of 20 feet or more.

Very respectfully, your obedient servant,

JNO. J. LEE,
Assistant Engineer.

Lieut. Col. G. WEITZEL,
Corps of Engineers, U. S. A.

ICE HARBORS.

In the last Annual Report my predecessor says on this subject the following:

The convenience or necessity of ice harbors in the Delaware has been fully recognized, and their construction provided for in successive river and harbor acts.

With the Marcus Hook Harbor enlarged, the New Castle Harbor completed with the exception of some dredging and minor expenses, and the ice-harbor at the head of the bay projected, the needs of the present commerce of the Delaware in this respect will have received full consideration.

The proper use and maintenance of the harbors should likewise be provided for. As pointed out in previous reports, their conveniences are largely improperly used by laying up vessels in them for the winter, thereby taking up a considerable space, frequently to the exclusion of other vessels in actual need of shelter while pursuing their voyages. It is for this class only that the United States have built these harbors. I respectfully renew the recommendation made in the last Annual Report, that, so long at least as the harbors shall be under construction, and therefore in charge of the United States Engineer Department, the officer in charge shall be authorized to appoint harbor-masters, who, under suitable regulations, shall be charged with the duty of regulating the use and occupancy of the ice-harbor, and be vested with the requisite powers to enable him to discharge it.

I fully agree with these views and recommendations.

The importance of the improvements on this part of the river are so apparent and has so often been stated that I need not urge it here again. The commercial statistics of Philadelphia and Wilmington exhibit it clearly. The utmost liberality should be exercised in making appropriations for this national highway.

The various sums which I have recommended to be appropriated for the five works which are included under the title of the appropriation "Delaware River below Bridesburg, Pennsylvania," aggregate $217,000. And this amount can be profitably expended during the fiscal year ending June 30, 1885.

Total appropriations to June 30, 1883	$671,000
Total expenditures to June 30, 1883	549,760

Money statement.

July 1, 1882, amount available		$74,821 91
Amount appropriated by act passed August 2, 1882		136,000 00
		210,821 91
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$88,464 97	
July 1, 1883, outstanding liabilities	1,117 02	
		89,581 99
July 1, 1883, amount available		121,239 92
Amount (estimated) required for completion of existing project		553,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		217,000 00

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on October 12, 1882, for dredging in Delaware River at Bulkhead Shoals.

No.	Names and addresses of bidders.	Contractor to use his own plant and place of deposit.	Contractor to deposit on Pea Patch Island with Government plant.	Date of commencement.	Date of completion.
		Per cu. yd.	*Per cu. yd.*		
1	The Delaware and Chesapeake Improvement Company, Philadelphia, Pa.	$0 37	.....	As soon as possible after signing contract. Time not given.	July 1, 1883
2	The National Dredging Company, Washington, D. C.	43	$0 43		

Contract awarded to the Delaware and Chesapeake Improvement Company; dated November 13, 1882; to be completed July 1, 1883; contractor to use his own plant and place of deposit.

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on October 13, 1882, for dredging in Delaware River near Petty's Island.

No.	Names and addresses of bidders.	Dredging.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	New York Steam Dredging Company, New York City.	$0 54½	Mar. 1, 1883	July 1, 1883
2	American Dredging Company, Philadelphia.....	*68 †48	Apr. 1, 1883	Dec. 15, 1883

* To deposit in accordance with specifications.
† To deposit otherwise than in accordance with specifications.

Contract awarded to New York Steam Dredging Company; dated November 16, 1882; to be completed June 30, 1883.

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on October 13, 1882, for dredging in Delaware River near the upper end of Petty's Island.

No.	Names and addresses of bidders.	Dredging.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	Frank C. Somers, Philadelphia.....	$0 53	At once.....	June 30, 1883
2	American Dredging Company, Philadelphia	35	....do	Dec. 1, 1882
3	New York Steam Dredging Company, New York City..	35¾	Nov. 15, 1882	Jan. 1, 1883

Contract awarded to American Dredging Company; dated October 31, 1882; completed.

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on October 14, 1882, for dredging in Delaware River at Mifflin Bar.

No.	Names and addresses of bidders.	Dredging.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	National Dredging Company, Washington, D. C	$0 44	April 1, 1883	June 30, 1883
2	The Delaware and Chesapeake Improvement Company, Philadelphia, Pa.	45	Omitted	June 30, 1883
3	New York Steam Dredging Company, New York City	38	Mar. 15, 1883	July 1, 1883

Contract awarded to New York Steam Dredging Company; dated November 16, 1882; to be completed June 30, 1883.

COMMERCIAL STATISTICS, DELAWARE RIVER BELOW BRIDESBURG, PENNSYLVANIA.

[From Maritime Exchange.]

American vessels entered from foreign ports, 1882:
With cargo, 447; tonnage, 271,322.
With ballast, 9; tonnage, 12,052.
American vessels cleared for foreign ports, 1882:
With cargo, 303; tonnage, 233,918.
With ballast, 34; tonnage, 8,966.
Foreign vessels entered from foreign ports, 1882:
With cargo, 698; tonnage, 632,706.
With ballast, 25; tonnage, 18,291.
Foreign vessels cleared from foreign ports, 1882:
With cargo, 643; tonnage, 564,399.
With ballast, 24; tonnage, 20,099.

Foreign entrances and clearances, 1882.

Vessels.	Entrances.		Clearances.	
	No.	Tonnage.	No.	Tonnage.
American	456	283, 374	337	242, 883
Austrian	33	18, 981	30	16, 614
British	358	418, 526	311	352, 380
Belgian	8	21, 039	9	23, 876
German	19	13, 663	20	15, 483
Italian	153	82, 857	147	78, 122
Norwegian	104	66, 367	104	69, 292
Russian	17	11, 460	16	9, 972
Swedish	9	5, 337	10	5, 892
Swiss	2	1, 536	.....	.....
Portuguese	4	967	4	967
Danish	10	6, 359	8	5, 717
Dutch	4	3 269	4	3, 269
Spanish	1	315	3	1, 069
Haytien	1	316	.....	.....
French	.....	.....	1	1, 755
Total	1, 179	934, 366	1, 004	827, 291

Coastwise clearances and entrances, 1882.

Vessels.	Clearances.	Entrances.
Steamers	1, 797	1, 846
Ships	21	11
Barks	78	33
Brigs	58	53
Schooners	3, 183	3, 748
Total	5, 137	5, 691

Exports of grain and petroleum during 1881, 1882, *and four months of* 1883.

Period.	Wheat.	Corn.	Petroleum.
	Bushels.	*Bushels.*	*Barrels.*
1881	8, 892, 260	6, 099, 434	2, 208, 193
1882	5, 852, 951	808, 599	1, 674, 944
1883, four months	1, 400, 887	2, 941, 314	266, 245

Total imports during 1882 ..... $37, 666, 489
Total exports during 1882 ..... 34, 529, 459

STATEMENT OF TONNAGE OVER THE PIERS OF THE PHILADELPHIA AND READING RAILROAD COMPANY ON THE UPPER DELAWARE FRONT DURING YEAR ENDING JUNE 30, 1882.

	Tons.
Anthracite coal	2,483,780
General merchandise	1,376,487
	Bushels
Grain (1882-'83)	5,215,028

STATEMENT OF TONNAGE OVER SAME SINCE 1874, SHOWING DEVELOPMENT OF TRADE DURING LAST NINE YEARS.

	Tons.		Tons.
1874	2,236,878	1879	3,241,817
1875	1,881,950	1880	2,983,870
1876	2,030,482	1881	2,910,850
1877	3,043,881	1882	3,494,956
1878	2,533,856		

STATEMENT OF VESSEL MOVEMENT FOR THE PAST YEAR TO AND FROM THE PORT RICHMOND ELEVATOR PIER.

Steamships	12
Barges (for general cargo steamers)	154
Ships	2
Barks	72
Brigs	6
Sloops and schooners	134
Barges (miscellaneous loading)	92
Total	472

The elevator company state that owing to the inferior quality of the grain, particularly corn, in the territory more directly tributary to this outlet, the export movement therefrom has not been one-half of the amount that would be ordinarily shipped under advantageous conditions of activity.

The W. Cramp & Sons Ship and Engine Building Company state that, from July 1, 1882, to July 1, 1883, they have built five steamships, one steam yacht, and three steam tow-boats, with an aggregate tonnage of 14,614 tons, and a value of $2,410,000.

G 3.

IMPROVEMENT OF DELAWARE RIVER AT SCHOONER LEDGE, PENNSYLVANIA AND DELAWARE.

The sum of $40,000 was appropriated for continuing this work by the river and harbor act, which passed August 2, 1882.

The history of its progress is fully set forth in the annexed report of the assistant in local charge, Mr. Thomas G. Locke.

It is situated in the collection district of Philadelphia, which is the nearest port of entry. The amount of revenue collected at that port during the past fiscal year was $12,251,310.52. The nearest fort and light-houses are, respectively, Fort Mifflin and the Schooner Ledge range lights. The sum of $57,000 should be appropriated for this work for the fiscal year ending June 30, 1885.

Total appropriations to June 30, 1883	$170,000
Total expenditures to June 30, 1883	162,432
Total estimated cost of the work	227,000

Money statement.

July 1, 1882, amount available		$16,377 54
Amount appropriated by act passed August 2, 1882		40,000 00
		56,377 54
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$44,344 75	
July 1, 1883, outstanding liabilities	4,464 60	
		48,809 35
July 1, 1883, amount available		7,568 19
Amount (estimated) required for completion of existing project		57,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		57,000 00

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on October 12, 1882, for removal of rock from Schooner Ledge, Delaware River.

No.	Bidder and residence.	Rate.	Date of commencement.	Date of completion.
1	American Dredging Company, Philadelphia, Pa	*Per cu. yd.* $21 00	Dec. 1, 1882	Dec. 1, 1883

Contract awarded to the American Dredging Company; dated October 31, 1882; to be completed December 1, 1883.

REPORT OF MR. THOMAS G. LOCKE, ASSISTANT ENGINEER.

MARCUS HOOK, PA., *June* 22, 1883.

COLONEL: I have the honor to submit the following report of progress made in removing Schooner Ledge, Delaware River, for the fiscal year ending June 30, 1883.

During the summer and fall following July 1, 1882, the work was carried on by operating contracts Nos. 2 and 3 simultaneously, thereby affording the contractors the opportunity of continuously drilling, blasting, and dredging up the material.

At the work there have been no noteworthy changes in the general method of breaking and handling the material.

No damage has occurred to the shipping, &c., passing the obstruction, owing, no doubt, to the accuracy of the Schooner Ledge range lights as a guide and to the aid given during the entire season of open navigation by the drilling plant, which, at work along the north west edge of the rock projecting above the 24-foot plane, was so well lighted that it was plainly visible, in clear weather, for at least 3 miles up or down stream. During the year the drilling and blasting has covered an area of 15,000 square feet.

For the season of 1882, work closed on December 8, owing to cold weather and drifting ice. During suspension of operations the machinery was overhauled and repaired and the "Burleigh" drills replaced by "Ingersolls," which have proved much superior in effectiveness and simplicity of construction.

Work was resumed on February 26, 1883, and has been continued unremittingly up to the present both by drill and by dredge.

The amount of material yet to be removed under contract of October 31, 1882 (No. 4), cannot be determined until a thorough examination has been made. Its width of 40 feet will add enough to the channel already made to extend it 180 feet southeast of line of range lights, or a full width of 330 feet of channel between the shoaling on either side.

The removal of this ledge from its inception, on account of the character of its material, should have been to a depth of 26 feet, so as to permit the passage of vessels of that draught, of which there are a few, as well as to give assurances of safety to vessels of 24-foot draught when deeply laden and outward bound.

The developments through operations under the fourth contract show the gradual disappearance of the ledge, and that it can be completely removed to the present projected depth of 24 feet, with an appropriation of $57,000, the balance of the original estimated cost of $227,000, of which $170,000 will have been expended at the close of this fourth contract.

Contract No. 2 (of August 28, 1880) was completed on November 25, 1882, the amount removed under it since June 30, 1882, being 442 cubic yards, and under the entire contract 1,965 cubic yards of broken rock and bowlders, and 2,172 of sand and gravel.

Contract No. 3 (of August 13, 1881) was completed on February 28, 1883. Under this contract 1,407 cubic yards of broken rock and bowlders and 1,695 of sand and

gravel were removed, of which 310 cubic yards of broken rock were removed during the present fiscal year.

Operations under contract No. 4 (of October 31, 1882), were begun on December 4, 1882, and continued with the usual winter suspension up to the present time, 729 cubic yards of broken rock, 643 of bowlders, and 3,566 of sand and gravel having been removed thereunder.

The removal of this ledge will benefit almost the entire maritime business of the Delaware River.

This work is in the collection district of Philadelphia, which is also its nearest port of entry, the amount of revenue collected there during the fiscal year amounting to $12,251,310.52. The nearest fort and light-house are, respectively, Fort Mifflin and the Schooner Ledge range lights.

Respectfully submitted.

THOS. G. LOCKE,
Assistant.

Lieut. Col. G. WEITZEL,
Corps of Engineers, U. S. A.

G 4.

IMPROVEMENT OF DELAWARE RIVER NEAR CHERRY ISLAND FLATS, PENNSYLVANIA AND DELAWARE.

The river and harbor act which passed August 2, 1882, made an appropriation of $100,000 for continuing this improvement.

The operations of the past fiscal year are so fully set forth in the annexed report of Mr. John H. Dager, the assistant in local charge of the work, that it leaves me nothing to say but that I concur in his views and recommendations.

The sum of $100,000 should be appropriated for this work for the fiscal year ending June 30, 1885.

It lies in the collection district of Delaware, with Wilmington as its nearest port of entry, at which the revenue collected during the past year amounted to $33,098.52. The nearest fort and light-houses are, respectively, Fort Delaware and Cherry Island range lights.

Total appropriations to June 30, 1883	$400,000 00
Total expenditure to June 30, 1883	356,316 27

Money statement.

July 1, 1882, amount available		$26,216 00
Amount appropriated by act passed August 2, 1882		100,000 00
		126,216 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$62,699 19	
July 1, 1883, outstanding liabilities	19,833 08	
		82,532 27
July 1, 1883, amount available		43,683 73
Amount (estimated) required for completion of existing project		122,720 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		100,000 00

Abstract of proposals received and opened September 21, 1882, by Lieut. Col. G. Weitzel, Corps of Engineers, for improving Delaware River near Cherry Island Flats, Pennsylvania and Delaware.

No.	Names and addresses of bidders.	Dredging.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	National Dredging Company, Washington, D. C	$0 23	"At once"	Aug. 15, 1883
2	American Dredging Company, Philadelphia, Pa	25	Mar. 1, 1883	Dec. 1, 1883

Contract awarded to the National Dredging Company; dated October 11, 1882; to be completed August 15, 1883.

REPORT OF MR. JOHN H. DAGER, ASSISTANT ENGINEER.

WILMINGTON, DEL., *July* 4, 1883.

COLONEL: I have the honor to submit the following annual report of operations for improving the Delaware River near Cherry Island Flats:

The construction of a ship-channel 24 feet in depth, by dredging through these flats, has been continued under the project of 1878.

Under the present contract, dated October 11, 1882, work was begun on the unfinished part of cut No. 10. After completing this, cut No. 11 was made on the west and No. 12 on the east side of the former improved channel, giving an available width of 470 feet of the desired depth. The length of each of these cuts is over 2 miles.

The character of the material in the upper and western part of the channel is that of soft mud, while that in the southern and eastern part is of a stiff mixture of mud and sand. No coarse material has yet been found. The bottom of the improved channel presents an uneven face, holes or pockets forming in places where soft strata occur by the scour of the current and the action of the propellers of heavy-draught vessels.

The depth at low water ranges from 26 to 31 feet, and its permanency may be assured, now that nearly all steamers use this channel. A number of instances might be given of vessels drawing 26 feet passing in on 2½ feet of tide at fair speed.

Although no extended survey was made, many soundings were taken and no signs of shoaling were found except in the upper part of the channel, which were very slight and were caused by vessels leaving the line of ranges too soon, cutting across the head of the middle ground inside the buoy, throwing the bottom out into deep water.

The material dredged from the flats is loaded into scows and towed to a shore basin and dumped. It is then redredged and loaded into cars, which are hauled by engines over an elevated tramway, and dumped on the marsh lands of the adjoining Delaware shore. The material, being of varying proportions of sand and mud, is much cut up by rehandling by the machines, and readily flows from 300 to 400 feet when dropped from a slight elevation, the impact materially assisting the flowage.

To indicate the relative positions of the dredges to the free channel, flags of regulation buoy colors have recently been displayed from staffs on the machines. This device was adopted in consequence of some vessels not keeping on the proper range, and passing to the outside of the machines, when they either grounded or, in the effort to prevent that, endangered the dredging plant. It was also an additional guide to incoming vessels, when the established ranges were obscured by fogs.

The third contract for this improvement was completed August 7, 1882, and operations under the present were commenced on December 6 following but on the 16th of the same month were stopped by the ice, and were not resumed until March 13 of the present year. It is expected to finish it by the beginning of September, 1883.

The following tables, &c., give the details and summaries of operations since the commencement of the work:

TABLE I.—*Details of dredging operations.*

No. of cut.	Begun.	Completed.	Width.	Amount removed.	Remarks.
			Feet.	*Cu. yds.*	
1.....	Oct. 10, 1879	Mar. 4, 1880	45	100, 890	West side of cut, 60 feet west of axis.
2.....	Mar. 5, 1880	May 17, 1880	40	113, 612	East side of cut, 25 feet east of axis.
3.....	May 18, 1880	June 23, 1880	25	70, 053	East side of cut, 50 feet east of axis.
4.....	June 24, 1880	Aug. 5, 1880	40	93, 922	East side of cut, 90 feet east of axis.
5.....	Aug. 6, 1880	Sept. 24, 1880	40	82, 957	East side of cut, 130 feet east of axis.
6.....	Sept. 26, 1880	Dec. 3, 1880	40	119, 065	East side of cut, 170 feet east of axis.
7.....	Apr. 20, 1881	July 7, 1881	40	128, 522	East side of cut, 210 feet east of axis
8.....	July 8, 1881	Sept. 21, 1881	40	127, 750	West side of cut, 100 feet west of axis.
Shoals ..	Sept. 22, 1881	Dec. 22, 1881	.....	126, 470	Shoals found midway of channel.
9.....	Dec. 23, 1881	June 28, 1882	40	146, 325	West side of cut, 140 feet west of axis.
10.....	June 29, 1882	Mar. 22, 1883	40	137, 017	West side of cut, 180 feet west of axis.
11.....	Mar. 23, 1883	May 16, 1883	40	105, 472	West side of cut, 220 feet west of axis.
12.....	May 17, 1883	June 30, 1883	40	101, 084	East side of cut, 250 feet east of axis.
Total to June 30, 1883.....			470	1, 453, 139	

	Feet.
Width of channel east of axis	250
Width of channel west of axis	220
Total width of channel June 30, 1883	470
Total width of channel June 30, 1882	390
Increase of width during year 1883	80

TABLE II.—*Details of dredging for year ending June* 30, 1883.

	Cubic yards.
Tenth cut	131,867
Eleventh cut	105,472
Twelfth cut	101,084
Total	338,423
Amount removed from June 30, 1882, to June 30, 1883	338,423
Total amount previously removed	1,114,716
Total material removed to June 30, 1883	1,453,139

TABLE III.—*Summary of appropriations and contracts.*

Appropriations.			Contracts.				Amount removed.	Amount expended.
No.	Date.	Amount.	Date.	Price.	Began.	Finished.		
				Per cu. yd.			*Cu. yds.*	
1	Mar. 3, 1879	$100,000	Sept. 8, 1879	$0 23	Oct., 1879	Aug. 14, 1880	396,235	$100,000
2	June 14, 1880	100,000	Aug. 16, 1880	21.7	Aug., 1880	Aug. 30, 1881	414,658	100,000
3	Mar. 3, 1881	100,000	Aug. 16, 1881	21	Aug., 1881	Aug. 7, 1882	413,358	100,000
4	Aug. 2, 1882	100,000	Oct. 11, 1882	23	Dec., 1882	Not completed..	228,888	56,316
	Total	400,000					1,453,139	

Amount unexpended, $43,684.

For the continuance of this improvement the sum of $100,000 will be required for the fiscal year ending June 30, 1885.

The commerce to be benefited by this improvement is that of the Delaware River in general, the statistics of which are also applicable to this work.

These flats lie in the collection district of Delaware, with Wilmington as their nearest port of entry, the revenue collected there during the past fiscal year amounting to $33,098.52. There are owned in the district one hundred and forty-one sailing-vessels, tonnage 11,348, and nineteen steam vessels, tonnage 3,769—an aggregate of 15,117 tons. Fort Delaware is the nearest fort, and the work is on the line of the Cherry Island range lights.

Very respectfully, your obedient servant,

JOHN H. DAGER,
Assistant Engineer.

Lieut. Col. GODFREY WEITZEL,
Corps of Engineers, U. S. A.

G 5.

IMPROVEMENT OF FRANKFORD CREEK, PENNSYLVANIA.

The river and harbor act which passed August 2, 1882, made an appropriation of $10,000 for this work, based upon the examination of the creek reported upon by Capt. William Ludlow, Corps of Engineers, dated Philadelphia, January 25, 1882. The estimated cost was $40,000. This appropriation was at first suspended by direction of the Secretary of War, but subsequently released.

The report of the assistant in local charge of the work, Mr. A. Stierle, which is appended hereto, is so complete that I have nothing to add, except that I fully concur in his views.

Frankford Creek lies wholly within the port of entry of Philadelphia, at which the revenue collected during the past fiscal year amounted to $12,251,310.52. The nearest fort and light-house are, respectively, Fort Mifflin and Horseshoe range lights.

Total appropriation to June 30, 1883	$10,000 00
Total expenditures to June 30, 1883	8,600 24

Money statement.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year	$509 30	
July 1, 1883, outstanding liabilities	8,090 94	
		8,600 24
July 1, 1883, amount available		1,399 76
Amount (estimated) required for completion of existing project		30,000 00

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on May 7, 1883, for improvement of Frankford Creek, Pennsylvania.

No.	Names and addresses of bidders.	Dredging.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	Frank C. Somers, Philadelphia, Pa	$0 28½	Aug. 10, 1883	Oct. 1, 1883
2	American Dredging Company, Philadelphia, Pa	23	At once.	Aug. 1, 1883

Contract awarded to American Dredging Company; dated May 15, 1883.

REPORT OF MR. A. STIERLE, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., July 1, 1883.

SIR: I have the honor to submit the following report on the improvement of Frankford Creek, Pennsylvania, for the fiscal year ending June 30, 1883.

A survey of this work was made in November, 1881, upon which a general project for its improvement was based. The project was embodied in a report submitted to the Department on January 25, 1882, a copy of this report having been subsequently printed in the Annual Report of the Chief of Engineers for 1882, pages 822–828.

The general project provided for a low-water navigation of 7 feet at the mouth, decreasing gradually to 3 feet at Frankford Avenue Bridge, with an average width of 50 feet at the bottom of the proposed channel.

The river and harbor act of August 2, 1882, appropriated $10,000 for the improvement of this stream. The appropriation, however, was not available until February of this year.

A project, previously submitted for the expenditure of this money, by dredging a cut 7 feet deep at mean low water and 50 feet wide at the bottom from the mouth of the creek to the bridge at Bridge street, was approved at the same time, and after the usual preliminary transactions, the contract was awarded to the American Dredging Company, of Philadelphia, at the low price of 23 cents per cubic yard.

Dredging operations commenced May 16, 1883, and were continued with great dispatch and few interruptions until June 30, when the contract was completed. The total amount of material removed was 35,178 cubic yards, all of which was deposited upon the adjacent banks and bulkheads of the creek. As the low contract price allowed for a greater quantity of material to be removed than had been estimated for, the specified width of 50 feet in the proposed cut was not strictly adhered to, and, wherever possible, was made as wide as the present banks of the creek would permit without endangering their stability. Above Bridge Street Bridge, within the first horseshoe bend of the creek, two considerable shoals, forming a serious obstruction to navigation at almost every stage of the tide, were also removed. The material dredged consisted of mud and sand at the mouth of the creek, changing gradually to hard sand and gravel up to the Arsenal Wharf, whence it remained so, with cobblestones added, as far as the dredging had progressed.

Attention was called in the original report printed last year to the irregularity of the banks and the faulty construction of the shore structures erected upon the same. Notwithstanding that the creek is entirely within the city limits of Philadelphia, and therefore under the supervision of the municipal authorities, no attempt has ever been made to enforce the introduction of well-planned shore lines or to prevent the constant encroachments upon the water-way which are made by property owners along its course. Old wharves and bulkheads are rebuilt, in nearly every case, fur-

ther out into the creek, without regard to the present narrowness and the most suitable direction of the channel. It was observed, during the progress of dredging operations, that ashes and cinders from certain factories near by are being continually dumped upon the banks in large piles that gradually push out into the creek. At one time, for the course of a whole day, the dredging machines brought up from the bottom of the channel near the mouth of the creek great quantities of marsh hay, used for packing purposes, that had been thrown overboard from some vessel or vessels.

Frankford Creek, with the numerous and large manufactories along its banks and in the vicinity, can be made a valuable medium of traffic if properly improved, and would soon recover some of its old-time commercial importance. At a small annual expense for dredging, a navigable channel of sufficient depth and width could easily be maintained. It is impossible; however, to make any permanent improvements as long as the present shore lines and the narrow water-way between the abutments of the bridges exist. No further appropriation is, therefore, recommended to be made until the city authorities, who at present have the sole direction of the regulation of the shore lines, succeed in reconstructing the latter in such a manner that any money appropriated by the United States for the improvement of the creek can be expended with more satisfactory results than it can at present.

COMMERCIAL STATISTICS.

A number of statements were obtained from manufacturers along the creek which are rather vague, nearly all containing the same figures as to capital invested and annual productions, as given in the statements printed in last year's Annual Report of the Chief of Engineers, pages 826, 827. All dwell upon the great increase which would take place if the creek was made navigable. Five schooners, one sloop, and twenty-eight canal-boats, including five lumber rafts, passed up the creek during the month of June, 1883, carrying a total of 3,136 tons of miscellaneous freight. It was stated that this was a "slack" month, and that traffic is much larger during other months of the year.

Very respectfully, your obedient servant,

A. STIERLE,
Assistant Engineer.

Lieut. Col. G. WEITZEL,
Corps of Engineers, U. S. A.

G 6.

IMPROVEMENT OF SCHUYLKILL RIVER, PENNSYLVANIA.

Dredging operations were in progress at the beginning of the fiscal year under a contract with the American Dredging Company of Philadelphia, dated September 6, 1881. Under this contract dredging was continued up to October 28, 1882, at which date the contract was completed.

By the river and harbor act which passed August 2, 1882, $25,000 were appropriated for continuing the improvement. This amount, together with an unexpended balance of $25,000 under a contract executed October 25, 1882, made $50,000 available for further improvement of the river.

In response to advertisements issued under date of September 12, 1882, inviting proposals for the work, bids were opened on October 16, 1882. The lowest bid, that of the American Dredging Company, not being strictly in accordance with the specifications, was, with the other bids, upon my recommendation and by authority of the Department, rejected. Subsequently, and by informal invitations, bids were received and opened on November 2 following, resulting in awarding the work to the National Dredging Company of Washington, D. C. A contract was then entered into with that company, under date of November 20, 1882, and dredging operations under the same were commenced December 1,

1882, and continued until December 10, when freezing weather compelled a suspension of work for the winter.

Operations under this contract, which called for dredging the channel between the mouth and Girard Point piers, were resumed in May, 1883, and were in progress at the close of the fiscal year.

The result of dredging operations for the year was the removal of a total of 166,911 cubic yards of material from the following-named localities along the river: Between the mouth and Girard Point piers, 109,913 cubic yards; between Girard Point piers and Penrose Ferry Bridge, 14,992 cubic yards; between Penrose Ferry Bridge and Yankee Point, 29,998 cubic yards; and between Yankee Point and Point Breeze, 12,008 cubic yards.

The condition of the work on June 30, 1883, can be stated as showing an increased area of channel-way, particularly on the lower section of the river between the mouth and Girard Point piers, where the width has been increased to 270 feet, with a depth of 24 feet at low water. From Girard Point piers to Gibson's Point there now exists a channel-way 150 feet in width and 20 feet in depth at low water, and from Gibson's Point to Chestnut Street Bridge a depth of 18 feet is available, which seems to answer the requirements of commerce for that portion of the river.

The prospective business in grain shipments at Girard Point would seem to demand increased channel facilities on the lower portion of the Schuylkill, and it is also equally important that the large and increasing shipments of petroleum from Point Breeze and Gibson's Point should receive additional aid and encouragement by increasing the width of the channel up to these points.

As the completion of dredging under the existing contract now in progress between the mouth and Girard Point piers will substantially accomplish the work proposed in the present project, and as it is evident that then the channel dimensions as regards width will be inadequate for the traffic of the Schuylkill River, I respectfully recommend a modification of the existing project for the improvement of the river, by increasing the width of the present 24-foot channel from the mouth to Girard Point piers to 400 feet, and to increase the width of existing 20 foot channel from Girard Point to Gibson's Point to 250 feet.

To make this increased width to the channel would require the removal of 418,000 cubic yards of material, at an estimated cost of $160,000.

During the present season it is proposed to continue dredging under the contract now in force and complete the work between the mouth and Girard Point piers under the existing project.

Next season, should an appropriation be made, and the amended project, as recommended, be approved, it is proposed to continue dredging so as to widen the existing 20-foot channel in the immediate vicinity of Gibson's Point and Point Breeze, along the Penrose Ferry Bridge reach and between Penrose Ferry Bridge and Girard Point piers. For that purpose an appropriation of $100,000 is asked. The assistant in local charge of this work is Mr. Thomas Valentine.

This work is in the collection district of Philadelphia, at which, as a port of entry, there was collected during the past fiscal year revenue to the amount of $12,251,310.52. The nearest fort and light-house are, respectively, Fort Mifflin and Schuylkill River range lights.

Total amount appropriated to June 30, 1883	$325,000 00
Total amount expended to June 30, 1883	299,779 18
Estimated cost of present project	374,700 00

Money statement.

July 1, 1882, amount available		$54,093 94
Amount appropriated by act passed August 2, 1882		25,000 00
		79,093 94
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$39,389 15	
July 1, 1883, outstanding liabilities	10,484 97	
		49,874 12
July 1, 1883, amount available		29,219 82
Amount (estimated) required for completion of existing project		74,921 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		100,000 00

Abstract of proposals (informal) received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on November 2, 1882, for dredging in Schuylkill River, Pennsylvania.

No.	Names and addresses of bidders.	Dredging.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	National Dredging Company, Washington, D. C	$0 25	Dec. 1, 1882	June 30, 1883
2	American Dredging Company, Philadelphia, Pa	25	Soon as practicable.	June 30, 1883
3	Delaware and Chesapeake Improvement Company, Philadelphia.	29	Not stated..	Not stated.

Contract awarded to National Dredging Company; dated November 20, 1882.

COMMERCIAL STATISTICS.

NUMBER OF VESSELS AT POINT BREEZE FROM JULY 1, 1882, TO JUNE 30, 1883, AND TOTAL SHIPMENTS OF PETROLEUM IN SAME PERIOD.

Ships	37
Barks	163
Brigs	2
Schooners	11
Barges	14
Total vessels	227
Total barrels	962,979

NUMBER OF VESSELS AND ESTIMATED SHIPMENTS OF PETROLEUM FROM GIBSON'S POINT FROM JULY 1, 1882, TO JUNE 30, 1883.

Ships	6
Barks	56
Brigs	9
Total vessels	71
Total barrels	207,821

NUMBER OF VESSELS AT AND SHIPMENT OF GRAIN FROM GIRARD POINT ELEVATORS FROM JULY 1, 1882, to JUNE 30, 1883.

Steamers	61
Ships	1
Barks	25
Brigs	5
Schooners	1
Sloops and barges	5
Total vessels	98
Total bushels	3,938,122

STATEMENT SHOWING NUMBER OF TONS TRANSPORTED IN AND OUT OF THE SCHUYLKILL RIVER BY MESSRS. S. AND J. M. FLANNAGAN FROM JULY 1, 1882, TO JUNE 2, 1883.

	Tons.
Coal	302, 134
Bricks	14, 228
Grain	398
Marble	12, 532
Iron	3, 234
Stone	14 340
Sand	33, 738
Clay	9, 423
Paper	381
Oil	313
Salt	841
Total	391, 662

G 7.

ICE HARBOR AT MARCUS HOOK, PENNSYLVANIA.

The river and harbor act which passed August 2, 1882, made an appropriation of $15,000 for continuing this work. The available balance on hand at the beginning of the last fiscal year was $39,00. I therefore proposed that the additional pier (No. 7) recommended by my predecessor should be first built. This was approved, and the work was placed under contract on October 25, 1882. This pier is located with its axis along the 18-foot curve and is about 225 feet ou from Walker's Wharf. With this wharf it will form a fourth line. The crib substructure was sunk during last month and settled quite unevenly, but the application of temporary loads will probably drive i down to equal bearings, or nearly so.

On the evening of September 16, 1882, while the weather was quiet, and after a steamer which had landed at Walker's Wharf had passed, the outer pier (No. 5) of the third line suddenly capsized over in an easterly direction and passed completely out of sigh. It carried all of its substructure with it, excepting a few piles on the inshore, or westerly side.

I received authority to remove the wreck, and with the view of saving as much as possible of the material for its reconstruction I was authorized to do this by the hire of plant and labor. This work has been slow, and was interrupted four and one-half months during the winter. But by the end of the fiscal year 201 face-stones and 70 paving-stones had been recovered which, with a little trimming, can be again used. In addition, over 100 pieces of concrete and about 300 cubic yards of rubble have been recovered. About 100 of the 98 piles have also been drawn. With a few exceptions all that have been drawn are found to have been completely broken off at or about the surface of the mud. About 90 per cent. have split heads from the driving of the grillage and platform bolts. The grillage is wrung, twisted, and broken into short pieces and splinters.

The inner pier (No. 6) of the same line standing inshore 100 feet from where No. 5 stood, and in about 14 feet of water, at low tide, shows signs of weakening. The off-shore side of the superstructure, where the low-water depth is about 16 feet, is now $1\frac{3}{4}$ inches below the inshore side. A steamer passing even at some distance causes a sway-

ing of the pier. It will be closely watched, and, if necessary, the superstructure removed.

Both of these piers were built under the contract of September 1, 1880, made by my predecessor, and were completed in October, 1881.

This harbor is very important to the commerce of the Delaware River and should be completed as soon as possible.

It is located in the collection district of Philadelphia. This is the nearest port of entry, the collections during the past fiscal year having amounted to $12,251,310.52. The nearest fort and light-house are, respectively, Fort Mifflin and Christiana light.

Total appropriations to June 30, 1883	$184,000
Total expenditures to June 30, 1883	154,009

Money statement.

July 1, 1882, amount available		$38,796 12
Amount appropriated by act passed August 2, 1882		15,000 00
		53,796 12
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$8,499 96	
July 1, 1883, outstanding liabilities	15,345 00	
		23,844 96
July 1, 1883, amount available		29,951 16
Amount (estimated) required for completion of existing project		50,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		40,000 00

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on October 12, 1882, for construction of pier in Marcus Hook Harbor, Pennsylvania.

No.	Names and addresses of bidders.	Total for pier with pile foundation.	Total for pier with crib foundation.	Date of commencement.	Date of completion.
1	Frank Pidgeon, jr., New York City	$18,689	$19,839	Not stated.	Sept. 15, 1883
2	Leiper & Lewis, Chester, Pa	14,400	16,500	This fall.	July 1, 1883

Contract awarded to Leiper & Lewis for pier with crib foundation; dated October 25, 1882.

G 8.

ICE HARBOR AT CHESTER, PENNSYLVANIA.

There was no money available for this work during the last fiscal year. None is asked for, as its maintenance is not justified by any benefit that commerce can derive from it.

Total appropriations to June 30, 1883	$32,933
Total expenditures to June 30, 1883	32,933

G 9.

ICE HARBOR AT NEW CASTLE, DELAWARE.

The contract of July 6, 1881, for building the additional Ice Pier N, was completed August 8, 1882. This exhausted the appropriation for the harbor.

At about the same time, with an allotment from the appropriation for

contingencies of rivers and harbor repairs were made at a cost of $250, to the lower corner of the stone superstructure of Pier L, which had been run into and damaged by an iron steamer.

According to the project this harbor is now complete. Repairs, however, are needed to one or two of the piers; the depth of water in the harbor needs to be increased and moorings placed for vessels using the harbor. These items are:

First. To reset the stone in south face of Pier K, which were forced in about 8 inches, excepting the two top courses, by a vessel striking them during a storm. To make these repairs the entire face will have to be removed, and concrete backing will be substituted for that now in place. The probable cost will be $500.

Second. To riprap the foot of Pier N, which recent (June 27) soundings show is being undermined by the flood tide at its lower end. The cost will be about $200.

Third. To enlarge the anchorage by increasing the 18-foot low-water area by dredging along a line joining the center of Pier H with the north corner of Pier I, and by making a 12-foot low-water depth between that line and the Warden's Line of solid filling. Convenient localities exist for depositing the dredgings above high water, and it is suggested they be so disposed of. Cost of dredging, $10,000.

Fourth. To drive clusters of piles for moorings or fastenings of vessels, on or along the Port Warden's Line, at a cost of $250.

The shoaling of this harbor was materially aided, if not entirely caused by an extended wharf below, which was removed some time ago. With this out of the way, it is believed any depth now secured would be permanent. At present, one-quarter of the protected area is of no value, owing to its shoalness.

The ice harbor of New Castle is in the collection district of Delaware, Wilmington being its nearest port of entry, at which the revenue collected during the past fiscal year amounted to $33,098.52. The nearest fort is Fort Delaware, and the nearest lights the Bulkhead Shoals range lights.

The amount required for the within project is, with contingencies, estimated at $12,000, which amount can be profitably expended during the fiscal year ending June 30, 1885.

Total amount appropriated to June 30, 1883	$130,000
Total amount expended to June 30, 1883	130,000

G 10.

ICE HARBOR AT THE HEAD OF DELAWARE BAY.

The river and harbor act which passed August 2, 1882, made an appropriation of $25,000 for the commencement of this work, and for the removal of sunken piers in the channel back of Reedy Island, Delaware.

At first this appropriation was held suspended by order of the Secretary of War. Subsequently, however, I was directed to remove the sunken piers at an expense not to exceed $5,000, and I was also directed to obtain more definite information respecting the location and manner of construction of the proposed structure. Both of these directions will be obeyed during the present fiscal year.

The annexed report of Mr. A. Stierle, the assistant in local charge, will give more detailed information.

The estimated cost of this work is given in the last Annual Report as

$406,090.47. This sum should be appropriated in annual installments of $100,000 for the sake of economy.

This work will be in the collection district of Delaware, with Wilmington, Del., as the nearest port of entry, the revenue collected there during the last fiscal year amounting to $33,098.52.

Total appropriations to June 30, 1883 ..... $25 000

Fort Delaware and Reedy Island light are, respectively, the nearest fort and light-house.

Money statement.

Amount appropriated by act passed August 2, 1882	$25,000	00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	74	78
July 1, 1883, amount available	24,925	22
Amount (estimated) required for completion of existing project	381,090	47
Amount that can be profitably expended in fiscal year ending June 30, 1885	100,000	00

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on May 5, 1883, for removal of old ice pier near Port Penn, Del.

No.	Names and addresses of bidders.	Removal of six piers, price for the lot.	Date of commencement.	Date of completion.
1	American Dredging Company, Philadelphia, Pa	$3,700	Aug. 1, 1883	October 1, 1883
2	Frank C. Somers, Philadelphia, Pa	3,985	June 15, 1883	October 1, 1883

Contract awarded to American Dredging Company; dated May 18, 1883.

REPORT OF MR. A. STIERLE, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., July 1, 1883.

SIR: I have the honor to submit the following report for the fiscal year ending June 30, 1883, upon the work entitled "Ice harbor at the head of Delaware Bay:"

The various reports issued from this office upon the necessity and importance of a larger ice harbor than those now existing for the commerce of the Delaware River have succeeded in awakening the interest of commercial and maritime corporations concerned therein, and a beginning towards the construction of one, within a definite section of the river can now be made.

The river and harbor act of August 2, 1882, appropriated $25,000 for this purpose and "for the removal of sunken ice piers in the channel back of Reedy Island."

It was proposed in the project submitted to the Chief of Engineers, United States Army, on August 16, 1882, to apply part of this sum to the removal of the piers, and with the balance to construct one or two bays of the kind of structure as described in the last Annual Report as a preliminary test of its strength. Other examinations of the subject to be carried on simultaneously.

The project, as far as it relates to the removal of the sunken piers, was approved by the honorable the Secretary of War as late as February 2 of this year. The consideration of the other proposed measures was ordered to be "necessarily deferred until more definite information respecting the location and manner of construction of the proposed structure is obtained from the officer in charge."

Advertisements inviting proposals for the removal of the six sunken piers were published soon thereafter, and only two bids were received; but being somewhat below the estimate the contract was awarded to the American Dredging Company of Philadelphia in May, the piers to be removed before October 1, 1883, at the round sum of $3,700. At the end of the fiscal year the work had not been commenced.

It is proposed during the current fiscal year to complete the removal of the ice piers and to make extensive examinations of the bottom in the vicinity of Reedy Island and further down the bay; also, a series of current observations with the view of selecting the most favorable point where the ice harbor can be located. The style and man-

ner of construction, which will depend wholly upon these data, will be determined upon subsequently, and the revised plans and estimates can be submitted in time for Congress to act upon.

It is not necessary to append hereto the required commercial statistics, as the whole maritime interest of the Delaware River and Bay is concerned in this improvement, and the statistics collected and compiled at other points under improvement and given in their respective annual reports will apply to this as well.

* * * * * * *

Very respectfully, your obedient servant,

A. STIERLE,
Assistant Engineer.

Lieut. Col. G. WEITZEL,
Corps of Engineers, U. S. A.

G 11.

IMPROVEMENT OF WILMINGTON HARBOR, DELAWARE.

The sum of $50,000 was appropriated by the river and harbor act which passed August 2, 1882, for continuing this improvement.

The history of the work done under this appropriation and the commercial statistics of the port of Wilmington are fully set forth in the annexed report of the assistant in local charge of the work.

The amount required to complete this work is estimated at $191,384, of which the sum of $75,000 could be profitably expended during the fiscal year ending June 30, 1885.

Wilmington is a port of entry and is in the collection district of Delaware. The revenue collected there during the last fiscal year amounted to $33,908.52. The nearest fort and light-house are, respectively, Fort Delaware and Christiana light.

Total appropriations to June 30, 1883	$183,000 00
Total expenditures to June 30, 1883	179,195 58

Money statement.

July 1, 1882, amount available		$32,443 58
Amount appropriated by act passed August 2, 1882		50,000 00
		82,443 58
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$68,226 23	
July 1, 1883, outstanding liabilities	10,412 93	
		78,639 16
July 1, 1883, amount available		3,804 42
Amount (estimated) required for completion of existing project		191,384 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		75,000 00

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on October 17, 1882, for dredging in the Christiana River, Wilmington, Del.

No.	Names and addresses of bidders.	Dredging.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	Delaware and Chesapeake Improvement Company, Philadelphia.	$0 29½	Nov. 15, 1882	In 2⅓ to 3½ months.
2	National Dredging Company, Washington, D. C.....	31	Time not stated.	Time not stated.

Contract awarded to Delaware and Chesapeake Improvement Company; dated November 4, 1882.

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on October 18, 1882, for constructing 270 feet additional of jetty at mouth of Christiana River, Wilmington, Del.

No.	Name and address of bidders.	Total price.	Date of commencement.	Date of completion.
1	Isaac Neveling & Son, Philadelphia.....	$9,500 00	Not stated in bid.	

Contract awarded to Isaac Neveling & Son; dated November 1, 1882; to be completed December 1, 1882.

REPORT OF MR. JOHN H. DAGER, ASSISTANT ENGINEER.

WILMINGTON, DEL., *July* 6, 1883.

GENERAL: I have the honor to submit the following report of operations for improving Wilmington Harbor, Delaware, for the fiscal year ending June 30, 1883.

THE JETTY.

At the date of the last Annual Report about one-half the pile work had been driven, and only 100 linear feet had been completed and filled with stone, of the jetty which was being constructed from the light-house dike out into the Delaware River on the north side of the Christiana. At the present time the structure is complete except the paving for a length of 1,100 feet and the stone filling of the pier above low water and decking the same. It is expected to finish the same by the 1st of August, proximo.

The first contract was for a jetty 1,470 feet long, and was to have been completed October 1, 1882, but owing to detention by high tides and unfavorable weather the contractors were unable to fulfill the contract and an extension of time was granted them until December 1, 1882.

On November 1, 1882, a contract for building an additional 270 feet of jetty was awarded the same parties, the date of completion being December 1, 1882, but in consequence of bad weather setting in early in the season and ice interfering, a further extension of time on each contract was given until August 1, 1883, to complete, their work. The length of piles originally required was from 27 to 30 feet. Those put down this season have been increased to 45 and 50 feet in length, consequent upon encountering soft bottom.

A supplemental contract was made for the increased length of piling, amounting to $300.

The jetty is 1,740 feet long, extending from the shore to the 15-foot curve in the Delaware River and was designed, by regulating the flow of water out of the mouth of the Christiana River (which is fan-shaped) to prevent the formation of a bar therein. At this time sufficient observations have not been made, owing to its recent construction, to present any facts as to the effect produced.

The strong currents sweeping past the outer face of the pier or head of the jetty will require some deposit of stone to prevent cutting of the soft bottom. A twin-structure would be advisable for the south side of the Christiana River. No estimate is given for this, as a line for solid filling will soon be laid out by the newly appointed Board of Commissioners, whose jurisdiction under the laws of the State of Delaware covers the entire water fronts of the City of Wilmington, which is supposed will occupy the proper position for a jetty. It is very probable that the owners of the adjacent marshes will inclose from the established line and raise their lands above overflow, which will make their properties salable and valuable for manufacturing purposes, owing to the rail and water facilities for trasportation.

The removal of the abandoned buoy wharves near the Christiana light-house is recommended.

DREDGING.

During the past year dredging has been done in Wilmington Harbor and Christiana River for the improvement of navigation as follows:

On November 7, 1882, the Delaware and Chesapeake Improvement Company began work in the upper part of the river about 100 feet above the Reading Railroad Wharf, on the south side of the then existing 12-foot channel. A cut 20 feet wide and 12 feet deep was made from the initial point to the upper end of the Pulp Works Wharf, removing 12,552 cubic yards of stiff mud mixed with sand and wood refuse. The

sand was evidently brought in by Mill Creek, a small stream debouching here and which drains a large territory west of the river. This cut was completed January 4, 1883, when work was begun on the gravel bar east of the Market Street Bridge. Two cuts, each 20 feet wide, were made from opposite Warner's coal hoist to the center of the draw of the bridge, about 100 feet in length and 13 feet deep at low tide; 1,120 cubic yards of hard gravel and clay intermixed with bowlders were excavated.

Dredging was suspended January 11, on account of ice, and was resumed February 19 at the mouth of the river, and was carried on continuously until May 29, 1883, when the funds were exhausted. The excavation here amounted to 107,006 cubic yards of soft mud, slightly tempered in places with sand, and extended from the 15-foot curve in the Delaware River opposite the mouth to a point 225 feet east of the sunken pier in the Christiana River, a distance of 4,200 feet. The total amount of material removed under Delaware and Chesapeake Company's contract was 120.678 cubic yards, and was mainly deposited behind a bulkhead on the Delaware front, which, in connection with the jetty, inclosed a large dumping ground unaffected by the currents.

A considerable quantity of heavy matter is constantly being brought from the hillsides and the streets of Wilmington into the river through the medium of small tributaries and the sewers.

"Shipley Run" passes through a basin and empties into the river through the Harlan and Hollingsworth Company's ship-yard. It drains an area of about 500 acres, most of it being steep, with a gravel or clay soil. The Street Commissioners clean the basin out annually, removing 1,000 cubic yards, and the company spend yearly from $700 to $1,000 in keeping their frontage clear from the deposit from this run.

The streets of Wilmington which approach the river are steep, and large quantities of matter are carried down by every rainfall. There are thirteen traps or catch-basins in use, situated at the railroad crossings of the streets. They are 15 feet long, 3 feet wide, and 4 feet deep each, and are cleaned weekly. Besides the trapped surface drainage there are numerous sewers leading into the river, the deposit from which is mainly house sewage.

ESTIMATES.

For the removal of the light-house wharves near the site of the abandoned buoy depot	$500
For riprap stone, to be placed on the outer face of the pier at the mouth of Christiana River	150
For dredging a channel, 15 feet deep and 150 feet wide, from a point 300 feet below the rolling-mill wharf (the terminus of the present season's work) up to the Third Street Bridge (8,000 linear feet), 140,000 cubic yards of soft mud, at 30 cents	42,000
For dredging a channel of same dimensions as above from the Third Street Bridge to the Market Street Bridge (3,900 linear feet), varying from soft mud to hard sand and gravel, 120,000 cubic yards, at 32 cents	38,000
For the removal of rock in this reach opposite the Diamond State Iron Works, 657 cubic yards of hornblende gneiss, at $35	22,995
For dredging same width and depth as above stated from the Market Street Bridge to the Delaware Western Railroad Bridge (2,400 feet), 80,000 cubic yards of sand, gravel, and clay, at 40 cents	32,000
For dredging a like channel from the Delaware Western Railroad Bridge to Pulp Works (2,500 linear feet), 95,000 cubic yards of material, varying from stiff mud and sand to hard gravel and sand, at 40 cents	38,000

RECAPITULATION.

Removal of wharves	$500
Riprap stone	150
Dredging	150,400
Rock excavation	22,995
Superintendence and contingencies	17,339
Total cost	191,384

WILMINGTON HARBOR STATISTICS.

Table showing the maritime business of the port of Wilmington, Del., from June 1, 1882, to June 1, 1883.

Cargoes.	Tonnage.	Value.
Brick	300	$1,600
Coal	141,800	673,550
Cement	300	4,500
Canned goods	1,000	93,395
Fertilizers and fertilizing materials	60,000	1,320,000
Flour	2,000	160,000
Grain	8,500	297,500
Iron	46,900	1,876,000
Iron ore	3,243	24,322
Ice	14,000	70,000
Lumber (31,750,000 feet)	79,290	792,900
Machinery	----------	276,000
Merchandise	50,000	5,000,000
Meal	7,000	238,000
Paper and paper materials	7,500	877,000
Rails (steel)	150	7,000
Sand	40,292	61,338
Saltpeter and potash	2,100	252,000
Wood	41,500	124,500
Total merchandise	505,875	12,149,605
22 vessels built	13,335	1.773,555
345 vessels repaired	45,800	458,000
Total amount of trade	565,010	14,381,160

LIST OF VESSELS AND TONNAGE OWNED IN THIS DISTRICT.

	Number.	Tonnage.
Sail	141	11,348
Steam	19	3,769

Warner's freight line carries annually to Philadelphia 40,000 tons merchandise and to New York, 75,000 tons. Bush's line carries annually to Philadelphia 30,000 tons merchandise.

The harbor supports three tugs. Their towage for the past year amounted to four hundred and forty-three vessels in and four hundred and thirteen out. About one-half as many more are towed by foreign tugs.

During the season three steam passenger boats make two trips daily between Wilmington and Philadelphia, and a steam ferry-boat makes four trips daily across the Delaware River to Penn's Grove, N. J.

There is a large carrying trade in fish, oysters, and truck by small craft, the value of which cannot be estimated.

I am, general, very respectfully, your obedient servant,

JOHN H. DAGER,
Assistant Engineer.

General G. WEITZEL,
Lieut. Col. of Engineers, U. S. A.

G 12.

IMPROVEMENT OF BROADKILN RIVER, DELAWARE.

The history of this improvement is given in the Annual Report of the Chief of Engineers, United States Army, for 1881, beginning on page 780.

The river and harbor act which passed August 2, 1882, made an additional appropriation of $5,000 for this work. A project for the expenditure of the sum having been called for, I recommended that, in consequence of the lateness of the season and the proximity of the next session of Congress, during which additional legislation might be made in regard to the river, and the smallness of the sum which was then available to begin the work, with any hope of receiving an adequate re-

turn for the outlay, the expenditure of the above-mentioned appropriation, as well as the available balance from the two previous appropriations, be delayed. This recommendation was approved. Congress having taken no action in the matter at its last session, nothing has been done on the work. Hereto is attached the report of the assistant in local charge of the work, Mr. Joseph N. Odiorne.

This work is in the collection district of Delaware, Wilmington being the nearest port of entry. The amount of revenue collected there during the past fiscal year was $33,098.52. The nearest fort and light-house are, respectively, Fort Delaware and Delaware Breakwater light.

Total appropriations to June 30, 1883	$25,000 00
Total expenditures to June 30, 1883	11,622 42

Money statement.

July 1, 1882, amount available	$8,977 58
Amount appropriated by act passed August 2, 1882	5,000 00
July 1, 1883, amount available	13,977 58
Amount (estimated) required for completion of existing project	31,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	31,500 00

REPORT OF MR. JOSEPH N. ODIORNE, ASSISTANT ENGINEER.

The project for the expenditure of the $5,000 appropriated by the act of August 2, 1882, for improving Broadkiln River, Delaware, as submitted to and approved by the Chief of Engineers, recommends that the expenditure of this, as well as the available balance from the two previous appropriations, be delayed until the next season. Consequently no work has been done on this stream during the past year. I would respectfully suggest that the sum now available be further withheld until some additional action is made by Congress.

Respectfully submitted.

JOS. N. ODIORNE,
Assistant.

COMMERCIAL STATISTICS OF BROADKILN RIVER, DELAWARE.

The town of Milton, at the head of navigation, has four saw-mills, two large planing mills, one fruit-canning factory, two fruit-drying factories, one phosphate factory, and six ship-yards of an average capacity of three vessels each per year, of a tonnage varying from 100 to 1,200 tons, and vessels built there receive the highest rating in the French, English and American Lloyds. During the past year, seven vessels, aggregating 3,200 tons, have been built there and if improvements were made to navigation of the creek this number would be greatly increased, also the size of the vessels. Close steamboat connection could also be made with New York and Philadelphia, and a large tract of farming country would be opened up that is now cut off from a market.

There are now trading in the creek regularly twenty vessels, averaging 100 tons each, and about thirty-five trips per year are made there by transit vessels.

EXPORTS.

100,000 feet oak timber	$25,000
1,000 piles	2,000
100,000 railroad ties	5,000
10,000 cords of wood	30,000
175 tons bark	4,375
10,000 bushels wheat	10,000
150,000 bushels corn	75,000
7,500 cases canned fruits	15,000
350,000 bushels charcoal	35,000
Total	201,375

IMPORTS.

60,000 bushels lime	$5,400
600 tons fertilizers	18,000
450 tons coal	2,700
500,000 bricks	5,000
Iron for shipbuilding	4,000
Lumber	15,000
General merchandise	125,000
Total	175,100

G 13.

IMPROVEMENT OF MISPILLION CREEK, DELAWARE.

The river and harbor act which passed August 2, 1882, made an appropriation of $3,000 for continuing this work.

This improvement was begun in 1879, under a project to obtain a mean low-water channel 6 feet deep and 40 feet wide from Milford to the bar at the mouth of the creek. This project has been adhered to. The operations during the past fiscal year are fully set forth in the annexed report of the assistant in local charge, Mr. Joseph N. Odiorne, who also furnishes the commercial statistics of the creek.

It is estimated that $3,500 will complete the existing project. If the bar at the mouth is to be improved it will require $55,000 additional. Both amounts could be profitably expended during the fiscal year ending June 30, 1885.

This work is situated in the collection district of Delaware, with Wilmington as its nearest port of entry, at which the revenue collected during the past fiscal year amounted to $33,098.52. The nearest light-house is Mispillion light, and Fort Delaware is the nearest fort.

Total amount appropriated to June 30, 1883	$13,000
Total amount expended to June 30, 1883	13,000

Money statement.

July 1, 1882, amount available	$54	32
Amount appropriated by act passed August 2, 1882	3,000	00
	3,054	32
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,054	32
Amount (estimated) required for completion of existing project	58,500	00
Amount that can be profitably expended in fiscal year ending June 30, 1885	58,500	00

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on October 9, 1883, for dredging in Mispillion Creek, Delaware.

No.	Names and addresses of bidders.	Dredging.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	American Dredging Company, Philadelphia, Pa	$0 44	Jan. 1, 1883	June 30, 1883
2	Frank C. Somers, Philadelphia, Pa	47	Dec. 1, 1882	June 30, 1883

Contract awarded to American Dredging Company; dated October 31, 1882.

REPORT OF MR. JOSEPH N. ODIORNE, ASSISTANT ENGINEER.

The improvement of this stream was begun in 1879, since which time $13,500 have been expended in removing the shoals inside the creek, beginning at Milford, the head of navigation, and proceeding down-stream.

The details of operations are given in the Annual Reports of the Chief of Engineers for 1880, 1881, and 1882. During the past year, with the appropriation of $3,000 made by the act of August 2, 1882, the work has been continued in accordance with the existing project. Contract for dredging was made October 31, 1882, and work was begun December 21, 1882, continuing until February 7, 1883. A channel 40 feet wide and 6 feet deep at low water was made through the shoal from Fork to Reed's and Watson's, and one cut 28 feet wide and 6 feet deep through Reed's and Watson's Shoal; 5,720 cubic yards of material were removed during the season. As the work was done in the winter months, progress was necessarily slow on account of the inclement weather and short days.

The improvement of this stream, as thus far carried out, has been of great benefit to the vessel-builders and to navigation generally, as the expense from delays in getting vessels up or down the creek has been greatly lessened. Shipbuilding at Milford is steadily on the increase: twelve vessels, varying from 100 to 1,000 tons (mostly of the larger class), were built there during the last fiscal year, and the number of vessels trading in the creek has increased.

With the $3,500 asked for to complete the removal of shoal the creek can be made navigable for its entire length for vessels of 6 feet draught at low water. This amount should be appropriated in one sum, as the price of dredging, which is always high for this work, would be still greater should a smaller appropriation be made.

The most serious obstruction to the navigation of this stream is at the mouth, and here great difficulty is always experienced in getting out the larger vessels built at Milford, while delays to the smaller craft are almost constant, and add greatly to the cost of freights. The improvement of the entrance is now of the greatest importance to the navigation of this stream. The project of Maj. William Ludlow, United States Army, as given in the Report of the Chief of Engineers for 1882, pages 769 to 772, would furnish the needed relief, though it is probable that in order to maintain the channel as proposed an additional short jetty would be required on the south side of the stream.

Amount (estimated) required for completion of existing project	$3,500
Amount that can be profitably expended on same in fiscal year ending June 30, 1884	3,500
Amount (estimated) required for a 4-foot low-water channel at the mouth.	55,000
Amount that can be profitably expended on same in fiscal year ending June 30, 1885	58,500

Respectfully submitted.

JOS. N. ODIORNE,
Assistant.

COMMERCIAL STATISTICS OF MISPILLION CREEK, DELAWARE.

Milford, about 18 miles by creek from the mouth, is a thriving town of about 3,000 inhabitants, whose most important business interests are shipbuilding and the lumber trade. Vessels built there are noted for superior staunchness, and twelve vessels, varying from 100 to 1,000 tons each, have been built there during the past fiscal year. If the improvement of this stream is continued, and especially if the project for the improvment of the entrance is carried out, the building of new vessels will greatly increase and larger ones will be built, while many vessels will go there for repairs that are now prevented by the obstructions to navigation. There are now nine vessels of from 75 to 125 tons trading regularly from the creek, and about an equal number of transient vessels make about ten trips each per year.

Milford, besides being near the oak forests of Delaware, is also the center of a large wheat and fruit growing district.

EXPORTS.

500,000 feet oak lumber	$125,000
10,000 piles	20,000
30,000 railroad ties	15,000
8,000 cords wood	24,000
50,000 bushels wheat	50,000
75,000 bushels corn	37,500
50,000 cases canned fruits	100,000
Total	371,500

IMPORTS.

25,000 bushels lime	$2,500
2,500 tons coal	15,000
1,000 tons fertilizers	25,000
Iron for shipbuilding	6,000
Lumber	20,000
General merchandise	225,000
Total	293,500

G 14.

IMPROVEMENT OF DUCK CREEK, DELAWARE.

The river and harbor act which passed August 2, 1882, made an appropriation of $2,000 for continuing this work. It was begun in July, 1881, by improving the entrance to the creek, and my recommendation that the existing project be followed was approved. The appropriation above referred to was placed under contract on October 31, 1882. Work was begun on February 19, 1883, and completed on March 14, 1883; 7,198⅔ cubic yards of material were removed and the fourth cut nearly completed. The expectations that had been based upon the stiffness of the material, that these cuts might maintain themselves, have unfortunately not been realized. The cuts made in 1880 and 1881 are now completely filled up, and the same thing will undoubtedly happen to the cut which has just been made. I therefore recommend no further appropriation for continuing the work on the bar until a project for protecting works, based upon a resurvey, can be made.

The estimated amount required by the existing project for the creek proper is $11,500. The estimated amount required for a resurvey of the mouth is $500. Total, $12,000, which could be profitably expended during the fiscal ending June 30, 1885.

Duck Creek is in the collection district of Delaware; Wilmington is its nearest port of entry, the revenue collected there during the past year amounting to $33,098.52.

Bombay Hook light is the nearest light-house and Fort Delaware the nearest fort.

The report of Mr. Joseph N. Odiorne, the assistant in local charge of the work, is appended hereto.

Total appropriations to June 30, 1883	$10,000
Total expenditures to June 30, 1883	10,000

Money statement.

Amount appropriated by act passed August 2, 1882	$2,000
July 1, 1883, amount expended during the fiscal year	2,000
Amount (estimated) required for completion of existing project	12,000
Amount that can be profitably expended in fiscal year ending June 30, 1885	12,000

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on October 9, 1883, for improving Duck Creek, Delaware.

No.	Names and addresses of bidders.	Dredging.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	American Dredging Company, Philadelphia, Pa	$0 24	May 1, 1883	June 30, 1883
2	Frank C. Somers, Philadelphia, Pa	24¾	Nov. 1, 1882	June 30, 1883

Contract, dated October 31, 1882, awarded to American Dredging Company; completed June 30, 1883.

REPORT OF MR. JOSEPH N. ODIORNE, ASSISTANT ENGINEER.

With the appropriation of $5,000 by the act of June 14, 1880, the work of dredging a channel 100 feet wide and 8 feet deep at low water through the bar at the mouth of Duck Creek was begun. This amount by the first estimate was deemed sufficient to complete this work, but a revised estimate submitted to the Department January 24, 1881, increased this amount $7,500. Of the latter sum $3,000 was appropriated by the act of March 3, 1881. The details of the work are given in the annual reports of the Chief of Engineers for 1881 and 1882. The act of August 2, 1882, appropriated a sum of $2,000 for continuing the work, and contract for dredging was made October 31, 1882. Work under this contract was begun February 19, 1883, and continued until March 14, 1883; 7,198⅔ cubic yards of material were removed and the fourth cut nearly completed. Had the former cuts retained their depth the channel would now be 100 feet wide and 8 feet deep for three-fourths of its length and 75 feet wide for the remaining quarter, but the cuts of 1880 and 1881 are now completely filled, and doubtless before a year expires the cut of this year will also be filled. This result is due to the fact that although the cuts are made through a stiff clay, the bay tides for about three-fourths of their duration run nearly perpendicular to the axis of the cuts, and deflect the creek tide completely from passing through the cuts. During the last quarter of the ebb, when the bay tide slackens, the creek tide then works slowly through the cuts, but it is too sluggish to have any but a very slight scouring effect. I would, therefore, respectfully suggest that no further money be expended in dredging the bar until some provision is made for protective works, as mentioned in the Report of the Chief of Engineers for 1881, page 788. Before any project for this is prepared a resurvey should be made of the locality, upon which to base estimates.

Respectfully submitted.

JOS. N. ODIORNE,
Assistant.

COMMERCIAL STATISTICS FOR DUCK CREEK, DELAWARE.

EXPORTS.

200,000 feet timber	$5,000
700 cords wood	2,100
12,000 bushels wheat	12,000
25,000 bushels corn	12,500
25,000 pounds wool	6,000
7,000 cases canned goods	20,000
150,000 baskets peaches	75,000
7,000 tons fertilizers	210,000
Farm produce	10,000
Drain tile	7,000
Evaporated fruit	50,000
Passenger traffic	5,000
Total	414,600

IMPORTS.

100,000 bushels lime	$7,000
12,000 tons fertilizers	204,000
32,000 tons coal	16,000
1,000,000 feet lumber	20,000
General merchandise to the value of	15,000
Passenger traffic	5,000
Total	267,000

The commerce of Duck Creek consists of one freight and passenger steamer of 288 tons; one steam tug; three sailing vessels, of 75 tons each; five barges, 150 tons each.

The creek was formerly used largely as a harbor of refuge by the craft navigating the Delaware Bay, but owing to rapid shoaling of the bar at the entrance it is now little used as a harbor. From its location the creek is a desirable point for such a harbor, and this point should be kept in view in case of further improvement.

G 15.

IMPROVEMENT OF COHANSEY CREEK, NEW JERSEY.

The river and harbor act which passed August 2, 1882, appropriated $5,000 for continuing this improvement. Work was begun on March 12, 1883, and the appropriation was exhausted on May 26, 1883. The history and results of this work are fully set forth in the accompanying copy of the report of the assistant in local charge, Mr. John J. Lee. I concur in his recommendations and views.

This work is in the collection district of Bridgeton, N. J., which is the nearest port of entry. The collections during the past fiscal year amounted to $3,088.49. The nearest fort and light-house are, respectively, Fort Delaware and Cohansey light.

Total appropriations to June 30, 1883	$36,000 00
Total expenditures to June 30, 1883	35,302 24

Money statement.

July 1, 1882, amount available	$6,498 41	
Amount appropriated by act passed August 2, 1882	5,000 00	
		11,498 41
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	10,800 65	
July 1, 1883, amount available	697 76	
Amount (estimated) required for completion of existing project	5,500 00	
Amount that can be profitably expended in fiscal year ending June 30, 1885	5,500 00	

In case the gas and water mains at the bridge are lowered, the expense of continuing the improvement to the "Nail Works" Bridge would be $5,500 additional.

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on October 12, 1882, for dredging in Cohansey Creek, New Jersey.

No.	Names and addresses of bidders.	Rate per cubic yard and deposit material.		Commence.	Complete.
		Above low water.	Above high water.		
		Per cu. yd.	*Per cu. yd.*		
1	Frank C. Somers, Philadelphia, Pa	$0 42	$0 57	April 1, 1883	June 30, 1883
2	Frank Pidgeon, jr., New York City	*53	*53	Not stated.	June 30, 1883

* Bid does not state as to deposit of material either "above high water" or "above low water."

Contract, dated November 7, 1882, awarded to Frank C. Somers; to be completed June 30, 1883.

REPORT OF MR. JOHN J. LEE, ASSISTANT ENGINEER.

FORT DELAWARE, DEL., *June* 30, 1883.

COLONEL: I respectfully submit the following report of operations for improving Cohansey Creek, New Jersey, for the year ending June 30, 1883:

This work of improvement has been in progress since 1873. The obstructions, with the exception of the mud flats at the mouth, were found to lie entirely within the city limits of Bridgeton, at the head of navigation, and were partly caused by the accumulation of sand and gravel brought down by rains from the hillsides, and especially rom the opening of new streets. The bed of the stream along the city front was in

1872 nearly bare at low water. On the commencement of the work effective measures were taken by the city authorities to stop the washing of the loose material from the streets and slopes into the creek.

The total appropriations to date for the improvement of this stream amount to $36,000. The original project contemplated the construction of a channel 4 feet deep at mean low water and 130 feet wide. In 1880 an amended project was adopted for bringing a 7-foot channel from the deep water below the lower steamboat wharf to Commerce Street Bridge, and thence to the "Nail Works" one of 6 feet.

At the close of the work in 1880 a 7-foot channel, 50 to 70 feet wide, had been made up to Broad Strcet Bridge, and one of the same depth, but of less width, between Broad Street and Commerce Street bridges. Above the latter the depth had been increased to 4 feet. At Broad Street Bridge a space was left undredged, owing to the gas and water pipes of the city crossing the stream at this point at a depth of not more than 4 feet at low water.

The city authorities have had the question of lowering these pipes under consideration for several years, but up to the present no action has been taken. Until these pipes have been placed at the required depth any further deepening of the channel above Broad street would be useless. The work of the last year, therefore, has been confined to that part of the creek lying below Broad street, and consisted in widening the 7-foot channel, straightening and correcting its limits, which were very irregular on both sides, and deepening such portions of it as, from filling in or other causes, were above the desired level.

Work was begun on March 12, 1883, and completed May 26, 1883; 22,500 cubic yards of sand and mud were removed, of which 21,429 were deposited along the shores of the creek above the low-water line, and 1,071 yards above high water. The average cost per cubic yard was 42.7 cents.

The result of the whole improvement is the formation of a 7-foot channel at low water up to within 100 feet of Broad Street Bridge, with a uniform width of 90 feet between the lower and upper steamboat wharves, and of 70 feet above that; beween Broad and Commerce streets it is about 40 feet wide. Above Commerce street to the "Nail Works" there is a depth of 4 feet.

As the rise of tide is fully 6 feet, it is considered that the improved channel below Broad Street Bridge is now sufficient for the needs of navigation to Bridgeton, and as any improvement above that point would be rendered of no avail by the gas and water mains at the bridge, no further appropriation is recommended until these pipes have been lowered to a proper depth. Should this be done, the estimate to continue the improvement to the "Nail Works" Bridge would then be as follows:

	Cubic yards.
Excavation at Broad Street Bridge	3,500
Excavation between Broad and Commerce streets	4,500
Excavation above Commerce street to "Nail Works"	3,000
	11,000
11,000 cubic yards, at 45 cents	$4,950
Contingencies	550
Total cost	5,500

From Bridgeton to the mouth of the creek, about 20 miles, there is an unobstructed navigation of ample depth. The cove, however, into which the creek discharges is a broad flat of soft mud and sand, deepening gradually to an ill-defined channel of about 5 feet at low water. No improvement is practicable at this point short of confining the waters of the creek by jetties or artificial banks extending to deep water, the cost of which would be altogether out of proportion to the present or prospective interests involved.

The following commercial statistics of the city of Bridgeton have been kindly furnished by Mr. Robert J. Buck, president of Cumberland Nail and Iron Works:

MERCHANDISE RECEIVED AND MATERIALS USED IN MANUFACTURES.

Coal	tons	48,400
Iron ore, pig-iron, &c	do	13,450
Tin	boxes	3,500
Stone lime	bushels	50,000
Lime	tons	2,280
Sand	do	7,950
Clay	do	820
Coke	do	800
Marble and bluestone	do	725

Bark	tons	300
Soda ash, &c	do	2,800
Fertilizers	do	800
Cement and plaster	barrels	500
Rosin and alkalies	pounds	1,000
Wool	do	300,000
Oyster-shells	bushels	230,000
Terra-cotta pipe	value	$1,000
Lumber	feet	6,250,000
Laths and shingles		685,000
Hides		4,000
Miscellaneous	tons	3,426

MANUFACTURED AND SHIPPED.

Nails	kegs	130,000
Gas and steam pipe	feet	3,000,000
Glass, hollow-ware and window	boxes	213,000
Glass, plate	tons	600
Jar trimmings	gross	5,000
Canned goods	tons	2,970
Canned goods	cans	1,150,000
Bricks		2,600,000
Cassimeres	value	$200,000
Machinery	do	$60,000
Soap	pounds	375,000
Coal tar	barrels	200
Shell lime	bushels	75,000
Grain and seeds	do	40,300
Wood	cords	635
Feed, hay, &c	tons	890

The steamer J. S. Ide, running between Bridgeton and Philadelphia, carries yearly about 16,800 tons of freight.

At the Marine Railway three vessels are built and about seventy-five are repaired annually.

Tonnage registered for the year at the custom-house, Bridgeton, 15,656 tons; number of vessels, 312.

Very respectfully, your obedient servant,

JOHN J. LEE,
Assistant Engineer.

Lieut. Col. G. WEITZEL,
Corps of Engineers, U. S. A.

G 16.

IMPROVEMENT OF SALEM RIVER, NEW JERSEY.

An appropriation of $1,500 was made for continuing this improvement, in the river and harbor act which passed August 2, 1882.

It was intended to expend this sum in continuing the improvement at Biddle's Landing, and proposals were invited last September. The only bid received was so excessive that I recommended its rejection and a postponement of further action. This was approved.

The annual report of Mr. John J. Lee, the assistant in local charge of the work, gives fuller information. The estimated cost of completing this improvement to Sharptown is $37,000.

Salem River is in the collection district of Bridgeton, N. J., which is the nearest port of entry, the revenue collected there during the past fiscal year amounting to $3,088.49. The nearest fort and light-houses are, respectively, Fort Delaware and Finn's Point range lights.

Total appropriation to June 30, 1883	$14,500 00
Total expenditure to June 30, 1883	13,009 34

Money statement.

July 1, 1882, amount available	$137 93
Amount appropriated by act passed August 2, 1828	1,500 00
	1,637 93
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	147 27
July 1, 1883, amount available	1,490 66
Amount that can be profitably expended in fiscal year ending June 30, 1885.	4,000 00

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on October 12, 1882, for dredging in Salem River, New Jersey.

No.	Name and address of bidder.	Dredging.	Commence.	Complete.
1	Frank C. Somers, Philadelphia, Pa	*Per cu. yd.* $0 78	Dec. 1, 1882	June 30, 1883

Recommended that it be rejected as exorbitant.

REPORT OF MR. JOHN J. LEE, ASSISTANT ENGINEER.

FORT DELAWARE, DEL., *June* 30, 1883.

COLONEL: I respectfully submit the following report on the improvement of Salem River, New Jersey, for the year ending June 30, 1883:

Since 1880 the appropriations for this improvement have been applied to the upper part of Salem River, which discharges into the Delaware near Deep Water Point, through a canal or artificial mouth.

The obstructions below Course's Landing, which is 9 miles from the Delaware and is the present head of navigation, consist of sand bars at the mouth, shoals at Biddle's Landing, and some minor shoals above, which have never been fully examined.

The sand bars at the mouth are variable in position and depth, but there is usually a passage of not less than 4 feet at low water, with a rise of tide of 6 feet. No improvement here would be effective without permanent works, the cost of which would not be justified by the interests involved, especially as the obstruction, at the worst, causes only temporary detention at low tide.

The appropriation of $3,000 in the act of March 3, 1881, was expended the same year in removing, as far as practicable, the obstructions at Biddle's Landing, but proved insufficient to complete the work. A channel 60 feet wide and from 6 to 7 feet deep was dredged through the sand bars from the canal to about 200 feet above the landing, leaving a distance of about 700 feet remaining to be cut through.

The shoal places above Hoxie's Bridge are not of much importance. A partial examination of them was made in 1878, but a more accurate survey will be necessary before attempting their improvement.

By the river and harbor act of August 2, 1882, $1,500 was appropriated for this work, and in September last proposals were invited for continuing the improvement at Biddle's Landing. Only one bid was received, and the proposed price per cubic yard was considered so excessive that the bid was rejected and further action was deferred for the present.

The cost of completing the proposed channel at this point and of removing the minor obstructions between here and Course's Landing will be $4,000.

For a half mile above Course's Landing there is good water; above that the creek shoals gradually, until, at 2 miles from the landing and 1 mile below Sharptown, there is only 2 feet water, with a slight tidal flow.

To extend the navigation from Course's Landing to Sharptown would require the excavation of about 100,000 cubic yards of material, at an estimated cost as follows:

100,000 cubic yards, at 30 cents	$30,000
Contingencies	3,000
Total	33,000

I have been furnished with the following commercial statistics of Upper Salem Creek by Dr. Charles Newton, of Sharptown:

AMOUNT OF FREIGHT RECEIVED AND SHIPPED BY UPPER SALEM CREEK LAST YEAR.

Lumber	feet..	3,000,000
Coal	tons..	5,000
Fertilizers	do...	4,000
Phosphates	do...	70,000
Corn	bushels..	40,000
Sweet potatoes	baskets..	200,000
Sweet potatoes	barrels..	50,000
White potatoes	do...	150,000
Melons		500,000
Cantaloups		800,000
Peaches	baskets..	100,000
Other fruits and sundries	value..	$100,000

A large amount of dry goods, groceries, &c.

A steamer of about 90 tons runs between Course's Landing and Philadelphia, and two more will run during the produce season. The population of Sharptown is 600, and of Woodstown 3,000.

Dr. Newton adds that if navigation should be extended above Course's Landing to Sharptown the amount of freight would be doubled.

Very respectfully, your obedient servant,

JNO. J. LEE,
Assistant Engineer.

Lieut. Col. G. WEITZEL,
Corps of Engineers, U. S. A.

G 17.

IMPROVEMENT OF CHESTER CREEK, PENNSYLVANIA.

The amount available for this work for the fiscal year which ended June 30, 1883, less that required for contingent expenses, was placed under contract on October 6, 1882, with Mr. Frank C. Somers, of this city.

The report of the assistant in local charge of the work, Mr. Thomas G. Locke, a copy of which is attached hereto and forms part of this report, gives the history of the work in detail. The tracing referred to by Mr. Locke is not transmitted, as I do not deem it of sufficient importance, the work being virtually closed.

The amount of material removed during the past fiscal year was 10,613 cubic yards. The shipments during the same period to manufacturers and dealers along the line of the creek were 22,000 tons of coal, 1,200 barrels of cement, and 2,500,000 feet of lumber.

This work is situated in the collection district of Philadelphia, which is also its nearest port of entry, the revenue collected there during the past fiscal year amounting to $12,251,310.52. Fort Mifflin and Schooner Ledge range lights are, respectively, the nearest fort and light-houses.

Total appropriation to June 30, 1883	$6,000
Total expenditures to June 30, 1883	6,000

Money statement.

July 1, 1882, amount available	$2,927	08
Amount appropriated by act passed August 2, 1882	3,000	00
	5,927	08
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	5,927	08

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on October 9, 1882, for improving Chester Creek, Pennsylvania.

No.	Names and addresses of bidders.	Dredging.	Commence.	Complete.
		Per cu. yd.		
1	American Dredging Company, Philadelphia, Pa	$0 54	Dec. 1, 1882	June 30, 1883
2	Frank C. Somers, Philadelphia, Pa	52	Dec. 15, 1882	June 30, 1883

Contract, dated October 23, 1882, awarded to Frank C. Somers; completed March 6, 1883.

REPORT OF MR. THOMAS G. LOCKE, ASSISTANT ENGINEER.

MARCUS HOOK, PA., *May* 24, 1883.

COLONEL: I have the honor to report that operations for deepening, by dredging, the channel of Chester Creek, Pennsylvania, to the projected depth of 7½ feet, mean low water, was begun by Mr. Frank C. Somers, in accordance with the terms of his contract with the United States, dated October 6, 1882, on the 2d of November following, and continued with satisfactory progress until forced to stop by the ice on December 9, which prevented towage of material to the dumping ground, which was an abandoned part of Old Ridley Creek, Pennsylvania.

During the winter delay the project for continuing the cuts as far as Third Street Bridge was abandoned at the request of the city authorities, who were constructing a permanent iron bridge across the creek at Second street, with an elevation insufficient to allow the dredging machine to pass out from above in case the work should be continued after setting the girders to bridge, and upon consultation the authorities having the matter in charge concluded a preference for the completion of the bridge, and requested the entire expenditure of the appropriation for dredging to be made from the mouth of the creek up to Second street, thereby securing a more advantageous width for navigation and the interests of the city, the principal traffic above the bridge being carried on in coal barges, passing up laden on the flood and out light on the ebb tide. The concentration of the entire funds at the mouth admitted of an improved width in all of 60 feet, with diverging mouth, so as to admit of easy entrance from Delaware River.

After the lapse of winter, dredging was again resumed on February 19, 1883, and continued to expenditure of appropriation on March 6, 1883.

Accompanying this report will be a tracing of the mouth of Chester Creek from a map of a survey made in the fall of 1880. The newly constructed bridge across the creek at Second street is designated by lines in red.

Along Edgmont avenue, on either side of the bridge of the Philadelphia and Reading Railroad, is a new platform wharf, built upon piles and covering a narrow mud flat as far as low-water mark. It is used on outer side of bridge for a freight landing for a steam packet, running from Chester to Philadelphia daily. On the inner side of bridge the wharf is used for general freight and produce landing. There seem to be two or three claimants to the property, among which I think, the United States is justly entitled to a show, as it foots out from Edgmont street approach to the United States ice-harbor, to which, however, it is of no use at present.

On the tracing the dredged cut lies between the two dotted lines and extends from 7½ feet at the mouth, maintaining that depth up to a point about 75 feet above Second Street Bridge, and is certainly sufficient for all present needs of navigation, considering that the city now has four permanent and one draw-bridge across the stream within a distance of two-thirds of a mile from the mouth. The amount of material removed was 10,613 cubic yards.

The shipments during the past year up this creek, to manufacturers and dealers along its line, were 22,000 tons coal, 1,200 barrels cement, and 2,500,000 feet lumber; the coal in canal-boats and the lumber in rafts.

* * * * * * *

Very respectfully submitted.

THOS. G. LOCKE,
Assistant.

Lieut. Col. G. WEITZEL,
Corps of Engineers, U. S. A.

G 18.

IMPROVEMENT OF RANCOCAS RIVER, NEW JERSEY.

The $10,000 appropriated by river and harbor act, which passed August 2, 1882, for continuing this improvement have been expended in deepening and widening the cut across Coates' Bar. There is now a channel through this obstruction 150 feet wide and 6½ feet deep at mean low water.

To continue this improvement to Centreton will cost, it is estimated, the sum of $22,000, all of which could be expended during the fiscal year ending June 30, 1885.

The annexed report of Mr. A. Stierle, the assistant in local charge of the work, gives additional details.

Rancocas River is in the collection district of Burlington, N. J., which is the nearest port of entry. Fort Mifflin is the nearest fort, and the Horseshoe range lights the nearest light-houses.

Total appropriations to June 30, 1883	$20,000 00
Total expenditures to June 30, 1883	19,148 10

Money statement.

Amount appropriated by act passed August 2, 1882	$10,000 00
July 1, 1883, amount expended during fiscal year	9,148 10
July 1, 1883, amount available	851 90
Amount (estimated) required for completion of existing project	62,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	22,000 00

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on October 9, 1882, for improving Rancocas River, New Jersey.

No.	Names and addresses of bidders.	Dredging.	Commence.	Complete.
		Per cu. yd.		
1	American Dredging Company, Philadelphia, Pa	$0 32	March 1,1883	June 30, 1883
2	Frank C. Somers, Philadelphia, Pa	49¾	March 1,1883	June 30, 1883
3	New York Steam Dredging Company, New York, N. Y.	59	March 1,1883	July 1, 1883
4	James Caler & Son, Baltimore, Md	*35 / †50	Not stated.	Not stated.

* Dump in river. † Place on bank.

Contract, dated October 31, 1882, awarded to American Dredging Company; completed May 31, 1883.

REPORT OF MR. A. STIERLE, ASSISTANT ENGINEER.

PHILADELPHIA, PA., *July* 1, 1883.

SIR: I have the honor to submit the following report upon the improvement of Rancocas River, New Jersey, for the fiscal year ending June 30, 1883.

The river and harbor act of August 2, 1882, appropriated $10,000 for the improvement of this river.

The Rancocas River is, with the exception of Maurice River, the largest tributary below Trenton flowing into the Delaware River from the east. It drains more than one-half of the area of Burlington County, New Jersey, and joins the Delaware River at Delanco, about 11 miles above Philadelphia. Its natural capacity for ordinary navigation is, for a distance of about 8 miles and up to the point where the river forks, exceptionally good, and requires comparatively less outlay for improvement than other rivers of the same size. Above the forks and along the north branch of the river (the one considered of more importance) the question of improvement is more complicated and expensive, on account of the greatly reduced width and power of the stream, which make it impossible to give it the same facilities for navigation which can be obtained in the lower section of the river.

The original project for the improvement of this river, based upon the survey made in 1880, provides for a mean low-water channel, 6 feet deep, from the mouth to Centreton, a distance of 7½ miles, and for a channel 5 feet deep at the same stage of water from Centreton, along the north branch of the river at Mount Holly, 5¾ miles further east.

With the appropriation made March 3, 1881, the improvement of the lower section of the river was inaugurated by beginning the removal of the first obstruction, called Coates' Bar, 4 miles above the mouth, over which the greatest depth at mean low water was only 3.7 feet. An account of the results of that year's operations was published in the Annual Report of the Chief of Engineers for 1882.

An examination made in August, 1882, showed that the channel dredged through the bar the previous year was permanent, the depth found at the close of operations having maintained itself throughout.

It was proposed to apply the appropriation made August 2, 1882, to the continuation of operations at this point by widening and deepening the channel previously made to 150 feet and 6½ feet respectively. Advertisements inviting proposals were published in September, 1882, and bids received and opened the following month, the contract being finally awarded to the American Dredging Company, of Philadelphia, at the price of 32 cents per cubic yard, the contract to be completed before June 30, 1883.

It was thought expedient not to begin operations until spring, the fall season being already too far advanced.

On March 26, 1883, the contractors commenced work with two dredging machines and continued until May 31, when their contract was completed, the amount allotted for dredging purposes having been expended and the project fully carried out.

Six cuts, each 25 feet wide and 6½ feet deep at mean low water, were made across the bar from the corresponding depths above and below, the average length of cut being about 1,350 feet. The total amount of material thus removed was 25,983 cubic yards of mud and sand and occasionally gravel, a portion of which was dumped into the deep holes of Mill Creek to the rear of Hamill's Island, and the remainder against the dike that closes the former outlet of Mill Creek.

It is generally believed that the channel, to the full width as dredged, will remain open, and that the strong currents sweeping through the same now will tend to prevent the accumulation of deposits in its immediate vicinity, so that the bar cannot reform.

Unless an examination of Coates' Bar, to be made hereafter, should indicate otherwise, it is not proposed to continue operations at this point with future appropriations, but to extend improvements further up the river, by removing the shoals and bars in the order in which they follow.

The points needing improvements are respectively as follows: Below Van Skivers, above Van Skivers, abreast of Busby's, above Joist Wharf, below Lime Works, and at Centreton. All require a deepening to 6 feet at low water, with a total estimated quantity of 55,000 cubic yards of material to be removed, which at the price of 40 cents per cubic yard will cost $22,000, the amount that can be profitably expended during the fiscal year ending June 30, 1885.

COMMERCIAL STATISTICS.

Seventy-two thousand tons of fertilizers are annually received and shipped at Centreton, at an average value of $30 per ton. There are other large and growing industries along the river, such as lumber and coal yards, molding-sand deposits, and mines of fire-clay, in regard to which no definite figures could be obtained.

Very respectfully, your obedient servant,

A. STIERLE,
Assistant Engineer.

Lieut. Col. G. WEITZEL,
Corps of Engineers, U. S. A.

G 19.

IMPROVEMENT OF SAINT JONES RIVER, DELAWARE.

The only appropriation made for this work was the sum of $5,000—by the river and harbor act of March 3, 1881. It was based upon a survey made in 1880, the report on which is dated Philadelphia, Pa., December 31, 1880. The estimates made for improving this river, in said report, from Dover down, so as to obtain a 3-foot low-water entrance,

was $35,000, and for a 4-foot entrance $42,500. In both cases the low-water navigation between the mouth and Lebanon was to be increased to 6 feet, and from Lebanon to Dover to 5 feet.

Numerous efforts have been made by those interested to have the available money expended on the river. Finally, Mr. Thomas Draper, of Dover, Del., requested the honorable the Secretary of War to order this to be done. The letter was referred to me for report. I made this report on June 16, 1883, and in it recommended that it be expended on the lower part of the river. This recommendation was disapproved. The following is the full text of the disapproval:

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., July 2, 1883.

SIR: Referring to your report of the 16th June upon the letter of Mr. Thomas Draper, of Dover, Del., in relation to the expenditure of the appropriation for improving Saint Jones Creek, the following copies of the indorsements of the Acting Chief of Engineers returning the letter to the honorable the Secretary of War and of the honorable the Secretary of War returning the paper to this office with concurrence in the views of the Acting Chief of Engineers are furnished for information:

"OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
"*June* 19, 1883.

"Respectfully returned to the honorable the Secretary of War.

"An examination of Saint Jones Creek was made in obedience to the requirements of the river and harbor act of June 14, 1880, and the report thereon, submitted to Congress in January, 1881, is printed in House Ex. Doc. 34, Forty-Sixth Congress, third session. The river and harbor act of March 3, 1881, appropriated $5,000 for the work, and a subsequent examination was made by Capt. William Ludlow, Corps of Engineers, under instructions from Col. J. N. Macomb, Corps of Engineers, the officer in charge, the results of which, together with the previous report upon the subject, was contained in Appendix F 17, of the Report of the Chief of Engineers for 1881 (copy herewith). These reports were submitted to the honorable the Secretary of War July 14, 1881, with the remark that since the appropriation made by Congress is but $5,000 it is manifest that but little, if any, good will be accomplished by its expenditure at the present time, and Colonel Macomb, the officer in charge, accordingly recommends that it be reserved until it can be ascertained if Congress will adopt the scheme of improvement for affording access to the creek from Delaware Bay.

"Colonel Macomb's recommendation was, upon the recommendation of the Chief of Engineers, approved by the Secretary of War July 19, 1881.

"By reference to Captain Ludlow's report it will be seen that there are conflicting interests in regard to the improvement, the parties representing them differing materially in opinion, both having secured charters from the legislature of the State of Delaware, under which they have organized as improvement companies, with the right to dredge, cut canals, &c., and to collect tolls from passing vessels after the improvements have been made. One of the companies (the Dover Company) have taken the precaution to have also inserted in their charter a provision authorizing them to expend such appropriations as Congress should see proper to make. In view of the facts above stated, it is believed to be the best policy to adhere to the decision already reached, that the expenditure of the existing appropriation be deferred until the wishes of Congress in the matter can be fully ascertained. Colonel Weitzel's views are accordingly not concurred in.

"JOHN G. PARKE,
"*Acting Chief of Engineers.*"

"The Secretary of War concurs in the views of the Acting Chief of Engineers.
"By order of the Secretary of War:

"JOHN TWEEDALE,
"*Chief Clerk.*

"WAR DEPARTMENT, *June* 21, 1883."

By command of Brigadier-General Wright.
Very respectfully, your obedient servant,
H. M. ADAMS,
Captain of Engineers.

Lieut. Col. G. WEITZEL,
Corps of Engineers, U. S. A.

This work is in the collection district of Delaware, the nearest port of entry being Wilmington, Del., at which the revenue collected during the past fiscal year amounted to $33,098.52. Fort Delaware is the nearest fort, and Mahon's River light is the nearest light-house.

Attached hereto is a copy of the annual report of Mr. Joseph N. Odiorne, the assistant in local charge of the work.

Money statement.

July 1, 1882, amount available	$4,882 10
July 1, 1883, amount available	4,882 10
Amount (estimated) required for completion of existing project	30,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	30,000 00

REPORT OF MR. JOSEPH N. ODIORNE, ASSISTANT ENGINEER.

The Department having approved the recommendation of Col. J. N. Macomb, United States Army, that the expenditure of $5,000, appropriated by the act of March 3, 1881, for the improvement of this stream, should be deferred until further action by Congress, and as no such action has been made, no work has been done on this stream during the past year.

I would respectfully suggest that this amount be further withheld until the next session of Congress, and should no action then be taken in regard to further appropriation for the improvement, that the amount now available be expended in removing the shoals inside the creek.

Respectfully submitted.

JOSEPH N. ODIORNE,
Assistant.

COMMERCIAL STATISTICS OF SAINT JONES RIVER, DELAWARE.

EXPORTS.

800,000 feet oak timber	$20,000
100,000 bushels wheat	100,000
175,000 bushels corn	87,500
3,500 railroad ties	1,750
300 cords wood	900
100 cords poplar wood, for paper	600
Canned goods to the value of	300,000
Total	510,750

IMPORTS.

3,500 tons fertilizers	$105,000
70,000 bushels lime	56,000
3,800,000 feet lumber	76,000
5,000 tons coal	30,000
500,000 shingles	2,500
General merchandise to the value of	200,000
Total	469,500

There are trading regularly in Saint Jones River six vessels, aggregating 400 tons, one small steam-tug, and about fifteen trips are annually made there by transient vessels. Dover, the capital of the State, is at the head of navigation, and the town of Lebanon, situated on the river, is about 9 miles below Dover. There are sent annually by rail from Dover about 500,000 baskets of peaches, but with a navigation made suitable for light-draught steamers, these, as well as many other products of the country, would be shipped by water.

G 20.

IMPROVEMENT OF MAURICE RIVER, NEW JERSEY.

The river and harbor act which passed August 2, 1882, made an appropriation of $3,000 for this work. The project for the improvement of this river contemplates the construction of a 6-foot low-water navigation to Millville, 24 miles from the mouth of the river, by the removal of obstructions extending from Millville to about 4 miles below.

The estimated cost of this improvement is $112,000, and as the sum appropriated was so small that it could not be expended with profit, the work was not begun.

A copy of the report of Mr. John J. Lee, assistant engineer, in local charge of the work is hereto attached and forms part of this report.

This work is in the collection district of Bridgeton, N. J. The amount of revenue collected at this port during the past fiscal year was $3,088.49. Bridgeton is also the nearest port of entry. The nearest fort and light-house are, respectively, Fort Delaware and Maurice River light.

Total amount appropriated to June 30, 1883	$3,000 00

Money statement.

Amount appropriated by act passed August 2, 1882	$3,000 00
July 1, 1883, amount available	3,000 00
Amount (estimated) required for completion of existing project	109,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	40,000 00

REPORT OF MR. JOHN J. LEE, ASSISTANT ENGINEER.

FORT DELAWARE, DEL., *June* 30, 1883.

COLONEL: The following report on the improvement of Maurice River, New Jersey is respectfully submitted.

Maurice River is one of the largest and most important streams in Southern New Jersey. In 1881 a survey of the river from the entrance to Millville, the head of navigation and 24 miles from the mouth, was made as called for in the act of March 3, 1881. A full report of the results of this survey was published in the report of the Chief of Engineers for 1882, pages 809 to 814.

The obstructions to navigation are confined to the approach from Delaware Bay through Maurice River Cove, and to the upper 4 miles below Millville.

The conditions at the entrance are unfavorable to an increase of channel depth. Broad flats, covered with not more than 4 or 5 feet of water extend from the mouth of the river a distance of 2¼ miles before reaching 6 feet at low water, with a depth increasing gradually for 4 miles more to the low-water curve of 12 feet. No dredged channel would remain open, and the cost of permanent dikes in such an exposed position would be very great.

A project and estimate for the improvement of the upper part of the river, by dredging a 6-foot low-water channel to Millville from about 4 miles below, were submitted with the report of the survey. A more minute survey of that part of the river will, however, be necessary before establishing definitely the lines of the improvement.

The act of August 2, 1882, contained an appropriation of $3,000, for commencing this work; but as the amount was too small to be expended to advantage, all operations were suspended by direction of the Secretary of War, until further appropriation may be made.

The Board of Trade at Millville, assisted by Col. J. Howard Willets, of Port Elizabeth, have furnished the following statistics of the towns along the banks of the river:

Millville is a manufacturing town of 9,000 inhabitants, and has fifteen hollow-ware furnaces, two window-glass furnaces, one cotton mill, two foundries, one bleachery, one machine shop, one canning factory, one saw-mill, and a ship-yard. A vessel of about 500 tons register is built every year. Thirty-five vessels are owned here and two tugs are constantly employed on the river. A steamer runs regularly to Philadelphia twice a week.

AMOUNT OF MERCHANDISE RECEIVED ANNUALLY.

Lumber	feet..	3,300,000
Sand	tons..	2,400
Lime	do...	260
Coal	do...	14,500
Clay	do...	3,000
Hay	do...	850

AMOUNT OF MERCHANDISE SHIPPED ANNUALLY.

Window glass	boxes..	64,000
Bottles	dozen..	5,000,000
Wood	cords..	2,500
Hay	tons..	11,250
Bricks		1,000,000
Hoops		400,000
Sand	tons..	14,000
Gravel	do...	5,000
Miscellaneous	do...	31,000

It is estimated that the commerce of Millville would be at least doubled if there was a good channel up to its wharves.

Port Elizabeth.—There is a glass factory here. About 1,500 cords of wood are shipped annually and much produce.

From *Bricksborough* 1,000 cords of wood are shipped annually and produce of all kinds.

Mauricetown.—Here there is a large ship-yard and marine railway; three vessels, averaging 900 tons register, are built annually and a registered of 5,000 is owned here, exclusive of oyster boats. The lumber for these vessels, amount not stated, is brought from Southern ports. A large amount of sweet potatoes and other produce is shipped, including 250,000 melons and about 1,200 cords of wood. Located here are a canning factory, a steam saw-mill, and lumber and coal yards. At the custom-house at this port forty vessels have received licenses beween March 27 and June 17, 1883.

Dorchester has a ship-yard and marine railway, where several vessels of from 500 to 1,000 tons are built yearly. From here, and from Watt's Landing below, much produce is shipped, and at all the above towns large quantities of coal, lumber, and miscellaneous merchandise are received, the total amount not being stated.

Port Norris, near the mouth of the river, is the headquarters of the oyster trade. It has a large oyster cannery and a marine railway where over one hundred vessels are repaired annually. The yearly amount of oysters brought into the river is 780,000 tons, a large portion of which are shipped by rail from Port Norris.

The total tonnage of vessels owned and plying upon the river is 24,918.

A wreck lying about 1½ miles from the mouth of the river is a dangerous obstruction to vessels bound in or out. Measures for its removal during the present season are now in progress.

Very respectfully, your obedient servant,

JOHN J. LEE,
Assistant Engineer.

Lieut. Col. G. WEITZEL,
Corps of Engineers, U. S. A.

G 21.

IMPROVEMENT OF MANTUA CREEK, NEW JERSEY.

By the river and harbor act which passed August 2, 1882, the sum of $3,000 was appropriated for the improvement of Mantua Creek, New Jersey.

A project for the expenditure of the appropriation was submitted to the Department under date of August 16, 1882, which was subsequently amended under date of August 23, 1882.

By letter from the office of the Chief of Engineers, United States Army, dated February 10, 1883, I was informed that the projects had

been withheld by order of the honorable the Secretary of War, until further appropriations are made. Consequently nothing was done in the direction of dredging in the channel of the creek during the past year.

The necessity for the improvement of Mantua Creek is based upon knowledge derived from a survey, or rather an examination, of that stream, made under the direction of my predecessor, Capt. William Ludlow, Corps of Engineers, during August, 1881. The objective point seems to be at the confluence with the Delaware River, and whatever amount of dredging may be done there to increase the depth of the existing channel, would have to be repeated each year. I therefore do not see the propriety or importance of recommending a further appropriation for this creek, until after further study and deliberation upon the subject.

This work is in the collection district of Camden, N. J., which is also the nearest port of entry. Fort Mifflin is the nearest fort, and Tinicum and Fort Mifflin Bar Cut Range lights are the nearest light-houses.

The amount collected at this port during the past fiscal year was $2,119.57.

Total appropriations to June 30, 1883 ..... $3,000

Money statement.

Amount appropriated by act passed August 2, 1882	$3,000 00
July 1, 1883, amount available	3,000 00
Amount (estimated) required for completion of existing project	32,000 00

G 22.

IMPROVEMENT OF WOODBURY CREEK, NEW JERSEY.

The history of operations on this work is fully given in my report to the Chief of Engineers, dated January 16, 1883, a copy of which follows. Nothing has been done on the work since that report was transmitted.

Money statement.

Amount appropriated by act passed August 2, 1882	$5,000	00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	450	31
July 1, 1883, amount available	4,549	69
Amount (estimated) required for completion of existing project	11,500	00
Amount that can profitably be expended in fiscal year ending June 30, 1885.	11,500	00

SURVEY OF WOODBURY CREEK, NEW JERSEY.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., January 16, 1883.

GENERAL: I have the honor to submit herewith the following report on the survey of Woodbury Creek, New Jersey, together with a tracing illustrating this survey.

The river and harbor act which passed August 2, 1882, contained an appropriation of $5,000 for the improvement of Woodbury Creek, New

Jersey. By letters from the Chief of Engineers, dated August 8 and 15, 1882, I was directed to submit a project for the expenditure of this sum. As nothing was known in this office about this creek, I recommended that a survey of that portion of the creek which it was desired should be improved first be made. This was approved by letter from the office of the Chief of Engineers, dated August 21, 1882.

The survey was conducted under the immediate direction of assistant E. A. Gieseler. A copy of his report is attached hereto and forms part of this report.

The improvement desired here by those interested is to obtain a depth of 8 feet of water at high stage from the Delaware River to Broad Street Bridge, in the town of Woodbury, N. J. Attached to Mr. Gieseler's report is a copy of a communication from several citizens of Woodbury, offering to keep and maintain the channel, when once improved by the Government, in good navigable condition. Another offer is made by one of the citizens to allow some marsh lands belonging to him to be used as a dumping ground for the dredged material.

Mr. Gieseler estimates the cost of dredging the desired channel at $15,000.

As an appropriation was made for this improvement without any previous survey, I am not required to state whether this is a work of public importance or not. The value of the commerce which uses this creek is estimated at $378,000 annually.

I am free to say, however, that whatever may be decided upon in regard to this work, it should not be begun until additional appropriations are made, sufficiently large, with that now on hand, to do the whole work at one time.

This work is in the collection district of Camden, N. J., which is also its nearest port of entry. Fort Mifflin is the nearest fort, and the Schuylkill range lights the nearest light-houses.

* * * * * * * *

Very respectfully, your obedient servant,

G. WEITZEL,
Lieut. Col. of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

REPORT OF MR. E. A. GIESELER, ASSISTANT ENGINEER.

PHILADELPHIA, PA., *January* 12, 1883.

GENERAL: I have the honor to report as follows upon the survey of Woodbury Creek, New Jersey:

The survey extended over that portion of the creek lying between Broad Street Bridge, Woodbury, and the mouth, a distance of about 5 miles measured on the water, and about 3 miles in a straight line. The field work was executed by Mr. Louis Quien, assisted by Mr. H. W. Barrett, between the 12th and 19th of September, 1882.

A polygon was run along the creek, the angles of which were observed with transits and the sides measured with a steel tape. Cross lines were sounded off at distances averaging about 300 feet, the soundings being taken by means of a graduated pole and located by means of angular observations from fixed points on the shore.

Two tide-gauges were established, viz, one near the mouth at a point called "Old Dam," and one at Broad street, Woodbury; while these gauges were being observed a series of simultaneous observations were made on our standard gauge at Fort Mifflin, for the purpose of establishing by means of these the tidal data of the creek. It was thus found that both high and low water traverse the distance from the mouth to Broad street in about the same time, somewhat more than half an hour, the low water traveling, probably, a little slower. The mean rise and fall of tide was found to re-

main practically the same throughout, it being about 6 feet at the mouth and about 5.9 feet at Woodbury.

The greater part of the course of the creek is through marshy land at about high-water level, banked in throughout, with the exception of a short stretch on the south shore immediately above the mouth. The general direction from Woodbury to the mouth is approximately a northwesterly one, frequently interrupted, especially in the lower part, by the strong sinuosities generally found in watercourses traveling through low marshy grounds.

Three bridges cross the creek, viz, the Red Bank Road Bridge, about 1⅓ miles above the mouth; the Crown Point Road Bridge, about 2 miles above the mouth; the Broad Street Bridge at Woodbury.

The first two named are draw-bridges of respectively 33 and 29 feet opening; the last-named bridge is permanent and forms the head of navigation.

Woodbury is the only town situated on the creek; it has a population of about 3,500 inhabitants, and contains several considerable establishments for the manufacture of patent-medicines, glassware, canned goods, and lumber. The export by means of the creek of these articles and the import, by the same means, of coal, glass-sand, fertilizers, and timber is considerable; a detailed statement about these matters will be found in a subjoined table. The trade of the creek is carried by canal boats and small sail and steam craft, nothing drawing more than 5½ or 6 feet being able to go up.

Mr. C. W. Starr, of Woodbury, gives the number of vessels that passed in and out of the creek during the six summer months of 1882 as follows: One hundred and seventeen barges, seventy-seven sloops, eighteen schooners, sixty-six steam vessels, making in all two hundred and seventy-eight round trips of all classes.

An increase of the channel depth from the present 6 feet to 8 feet at high water would, it is claimed, materially increase these figures, a point which Mr. C. W. Starr expresses himself upon as follows:

"If the depth could be increased so that 8 feet could be carried from the mouth to Woodbury, much would be gained. . Many freights of sand and lumber and coal, &c., are now refused by reason of the fact that vessels in the trade drawing more water than can be had in the stream, refuse to trade."

The navigation up to the Crown Point Bridge being satisfactory, an improvement is solicited only *above* this point; in order to discuss it we naturally commence by inquiring into the existing general conditions.

Woodbury Creek empties into the Delaware at a point where the duration of rise is about five hours and the duration of fall about seven and a half hours. Taking, therefore, into consideration the tidal prism only, the currents during ebb tide must necessarily be weaker than during flood tide, and we will actually find them so, unless the difference is made up by a sufficiently strong, fresh-water flow from above.

Again, the tidal flow not extending any further than about a mile above Woodbury, the tidal prism above this place is insignificant, and we may suppose *a priori* to find the currents in the upper part of the creek weaker than those in the lower parts.

These two points, the comparative strength of ebb and flood currents and of upper and lower currents, we now proceed to inquire into.

Considering two points of the creek, viz, the mouth and the vicinity of Woodbury, our survey and subsequent calculations furnish us with the following data to compute the mean ebb and flood currents:

Tidal prism above mouth	cubic feet..	17,000,000
Tidal prism above Woodbury	do....	1,000,000
Mean cross-section at mouth	square feet..	1,400
Mean cross-section at Woodbury	do....	200

The mean "cross-sections" given here are the means of normal high and low water cross-section (as taken from diagram No. 1) through which area the entire outflow and the entire inflow is supposed to take place, an assumption which for the purpose in view here is sufficiently accurate. The fresh-water flow has not been gauged, but an estimate of it has been made based on the appearance of the upper creek at very low water, and according to this estimate 50,000 cubic feet per hour is, during ordinary circumstances, the utmost limit. The expression "ordinary circumstances" here is intended to exclude the time of freshets.

From the above data we find the following:

A.—*Entire inflow during flood.*

At mouth: $17{,}000{,}000 - (5 \times 50{,}000) = 16{,}750{,}000$ cubic feet.
At Woodbury: $1{,}000{,}000 - (5 \times 50{,}000) = 750{,}000$ cubic feet.

B.—*Entire outflow during flood.*

At mouth: $17{,}000{,}000 + (7\frac{1}{2} \times 50{,}000) = 17{,}350{,}000$ cubic feet.
At Woodbury: $1{,}000{,}000 + (7\frac{1}{2} \times 50{,}000) = 1{,}350{,}000$ cubic feet.

From which figures, taking into consideration the duration of flood and ebb, we derive:

C.—*Mean inflow per hour during flood.*

At mouth: 3,350,000 cubic feet.
At Woodbury: 150,000 cubic feet.

D.—*Mean outflow per hour during ebb.*

At mouth: 2,313,333 cubic feet.
At Woodbury: 180,000 cubic feet.

Dividing these figures by the respective cross-sectional areas, we now find—

Mean velocities per hour during flood tide.—At mouth, 2,393 feet; at Woodbury, 750 feet.

Mean velocities per hour during ebb tide.—At mouth, 1,652 feet; at Woodbury, 900 feet.

Although these figures are not actual velocities, but merely the mean of the constantly-changing velocities that occur during the various stages of ebb and flood, yet the differences they show amongst each other must necessarily correspond to the differences amongst the actually-existing currents.

We find, then, that at the mouth the flood currents considerably exceed the ebb currents in strength, owing to the long duration of ebb and the small amount of fresh water carried by the creek. Again, we find that both flood and ebb currents are much weaker up at Woodbury than at the mouth, both of which conditions must be regarded as decidedly unfavorable. The strong lower flood currents will carry in sand and mud and deposit the same to a greater extent than the comparatively weak upper ebb currents are able to scour out. Hence, doubtless, the utter insignificance of the upper low-water cross-sectional areas, which are shown on Diagram No. 1. These conditions, unfavorable by themselves, are augmented by the irregular state of the high-water widths and (probably incident thereto) of the high-water cross-sectional areas, of which the necessary consequence must be an uneven flow tending to scour here and deposit there.

The removal of these unfavorable conditions is not only quite beyond the limits of any sum that might reasonably be expended on an improvement of the creek, but it is partly, perhaps entirely, impossible, and consequently we have from the beginning to deal with the improbability of permanence of any contemplated improvement.

If, notwithstanding this, I have the honor to submit a project of improvement, it is because there appears to be reasonable ground for the hope that the parties interested in the trade of the creek will maintain such improvement, when once made, at their own expense. Appended to this report is a document bearing on this question, and signed by leading citizens of Woodbury, which was transmitted to me by Mr. Starr.

A regulation of the creek in the proper sense being excluded from the first, the question of improvement is limited thereby to the wants of navigation and becomes a simple one.

A channel of 40 feet bottom width and 2 feet depth at low water would meet all requirements. This excavation should commence immediately above the Crown Point Bridge; following the present line of deepest water up to Broad Street Bridge, Woodbury, it would require the removal of about 30,000 cubic yards of material (which it may be supposed will all be soft).

Mr. Green, of Woodbury, according to a communication from Mr. Starr, is willing not only to allow the dumping of the excavated stuff on his meadows, which at high water are about 3 or 4 feet under water, but he will also pay for the stuff so dumped. As the mean hauling distance would thus be only three-quarters of a mile, and as the stuff might be dumped at high water from light-draught scows direct, I believe that a contract can be made at between 40 cents and 50 cents per cubic yard. At the latter rate the expense of the improvement would amount to $15,000.

Respectfully submitted.

E. A. GIESELER,
Assistant Engineer.

General GODFREY WEITZEL,
Lieut. Col. of Engineers, U. S. A.

ESTIMATE OF THE EXPORTS AND IMPORTS THROUGH WOODBURY CREEK, 1882.

[Statement received from C. W. Starr.]

IMPORTS.

Coal, 8,500 tons	$50,000	
Brick	8,000	
Stone	7,500	
Glass, sand, and soda, 2,500 tons	35,000	
Fertilizers, grain, and hay	35,000	
Lumber, 3,000,000 feet	40,000	
General merchandise	5,000	
Lime	2,500	
		$183,000

EXPORTS.

Glassware (hollow and window lights)	30,000	
Farm produce	50,000	
Canned goods and patent medicines	110,000	
General merchandise	5,000	
		195,000
Total value of exports and imports		378,000

LETTER OF JOHN J. ESTELL AND OTHER CITIZENS OF WOODBURY, NEW JERSEY.

WOODBURY, *January* 10, 1883.

MY DEAR SIR: The undersigned manufacturers and residents of the city of Woodbury, N. J., being deeply interested in the improvement of the navigation of Woodbury Creek, and knowing the vital importance of a water communication to the growing industries of our city, are of the opinion that, in event of a public expenditure of money for the purpose of straightening, widening, and deepening the channel of said creek, there could be in the futnre, as might be required from time to time, a sufficient sum of money raised from private sources to keep and maintain the channel in good navigable condition. And we who have hereunto set our signatures would be willing to pay a just and equitable proportion of same.

JOHN J. ESTELL,
Treasurer and Manager of Standard Window Glass Works.
G. G. GREEN,
Manufacturer.
C. C. VOORHIS,
Secretary Woodbury Glass Works.
JOHN E. ESTELL,
Dealer in Coal, Lime, Cement, and Fertilizers.
CHARLES WALTOR,
Coal and Lime Dealer.
BLIZZARD & PIERCE,
Steam Flour Mills.
L. BROWN & CO.,
Dealers in Lumber and Hardware.
LEWIS M. GREEN,
Mayor of City and Wharf Owner.
HENRY C. CLARK,
Vessel and Wharf Owner.
RALSTON, BUZBY & CO.,
Fruit Canners.
HENRY J. CLOUD,
Woodbury and Philadelphia Freight Line.

To E. A. GIESELER,
Assistant Engineer.

G 23.

IMPROVEMENT OF RACCOON RIVER, NEW JERSEY.

By circular letter from the office of the Chief of Engineers, United States Army, dated Washington, D. C., August 8, 1882, I was informed that the river and harbor act which passed August 2, 1882, had appropriated the sum of $3,000 for improving Raccoon River, New Jersey, and directed to submit a project for the expenditure of this sum.

The history of this work is fully given in my report to the Chief of Engineers, dated February 26, 1883, a copy of which is hereto attached. Nothing has been done on the work since.

Money statement.

Amount appropriated by act passed August 2, 1882	$3,000 00
July 1, 1883, amount expended during fiscal year	757 23
July 1, 1883, amount available	2,242 77
Amount (estimated) required for completion of existing project	16,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	16,000 00

SURVEY OF RACCOON RIVER, NEW JERSEY.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., February 26, 1883.

GENERAL: I have the honor to submit herewith the following report on the survey of Raccoon River, New Jersey, together with two tracings illustrating this survey.

The river and harbor act which passed August 2, 1882, contains an appropriation of $3,000 for the improvement of Raccoon River, New Jersey. By letters from the Chief of Engineers, dated August 8 and 15, 1882, I was directed to submit a project for the expenditure of this sum. As nothing was known in this office about that river, I recommended that a survey of that portion of the river which it was desired to improve be made first. This was approved by letter from the office of the Chief of Engineers, dated August 21, 1882.

The survey was conducted under the immediate direction of Assistant E. A. Gieseler. A copy of his report is attached hereto, and forms part of this report.

Raccoon River is situated in Gloucester County, New Jersey, and empties into the Delaware River opposite to Marcus Hook, Pennsylvania. The two principal towns situated on its banks are Bridgeport, with 500 inhabitants, about 2 miles above its mouth, and Swedesborough, with 600 inhabitants, about 7½ miles farther up. These two towns are the centers of large agricultural districts, but contain no manufacturing establishments of any kind. A considerable fishing interest is located in Bridgeport, which, with farm products, constitute the export trade of the river. The import trade consists chiefly in building material, manure, coal, and general merchandise.

The vessels trading on the river consist of five steamboats, two steam-tugs, six sloops, and four barges. The value of the export and import trade is given as little over $300,000 during last year.

A good channel of 4 feet at mean low water exists to more than half

the distance from the mouth to Swedesborough. The most serious obstructions are found within 2 miles of this town. It is estimated that the cost of improving this river, so as to make its navigation up to Swedesborough safer and less difficult for the small class of vessels now trading there, would be $13,800. To continue the improvement to Main Street Bridge in Swedesborough, it is estimated, would cost the additional sum of $4,140, or a total of $17,940.

As the appropriation for this improvement was made without any previous survey, I am not required to state whether this is a work of public importance or not. But it is my opinion that the work should not be begun until additional appropriations are made, sufficiently large with that now available, to do the whole work at one time.

This work is in the collection district of Camden, N. J., which is also a port of entry. Fort Mifflin is the nearest fort, and the Tinicum Island and Fort Mifflin Bar range lights the nearest light-houses.

* * * * * * *

Very respectfully, your obedient servant,

G. WEITZEL,
Lieut. Col. of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

REFORT OF E. A. GIESELER, ASSISTANT ENGINEER.

PHILADELPHIA, *February* 21, 1883.

GENERAL: I have the honor to report as follows upon the survey of Raccoon River New Jersey:

The survey extended over that part of the river lying between Main Street Bridge, Swedesborough, and the mouth, a distance of about 9½ miles, measured on the water, and somewhat less than 6 miles in a straight line. The field work was executed by Mr. Louis Quien, assisted by Mr. H. W. Barrett, between the 20th of September and the 7th of October, 1882. A polygon was run along the river, the angles of which were determined by transit observations, and the sides of which were measured with a steel tape. Cross lines were sounded off at distances, averaging about 300 feet, the soundings being taken by means of a graduated pole, and located by means of angular observations from fixed points on the shore.

Three tide-gauges were established, viz, one near the mouth, one half way up at Springer's Wharf, and one at Main Street Bridge, Swedesborough. While these gauges were being observed, a series of simultaneous observations were made on our standard gauge at Chester, for the purpose of establishing the tidal data of the river. It was thus found that the distance from the mouth to Swedesborough is traversed by the high water in about seventy minutes, and by the low water in about one hour and forty minutes. The duration of fall, therefore, is about half an hour shorter at the mouth than at Swedesborough. The mean rise and fall of tide from 6.2 feet at the mouth is reduced to 5.4 at Springer's Wharf, and to 4.5 at Swedesborough.

The course of the river in its lower portion is almost entirely through low-lying embanked meadows, above Springer's Wharf, however, these are frequently interrupted by stretches of high and hilly ground, forming the river banks. The general direction from Swedesborough to the mouth is approximately a northwesterly one.

The high-water width at the mouth averages about 450 feet, gradually declining to about 100 feet at Swedesborough. The high-water cross-sections at the mouth may be put at somewhat more than 4,000 square feet, and at Swedesborough at about 500 square feet. Tidal prism of the river has been computed at about 53,000,000 cubic feet.

A good channel of 4 feet minimal depth at low water and from 9 to 11 feet at high water runs more than half way up; in fact the serious and extensive obstructions to it are limited to the upper 2 miles.

Two towns are situated on the river, viz, Bridgeport, with 500 inhabitants, about 2 miles from the mouth; and Swedesborough, with 600 inhabitants, about 7½ miles farther up. No manufacturing establishments of any kind are located at either of these two towns, but both are centers of a large agricultural district, the products

of which are shipped to the Philadelphia market by way of the river. Beside the trade to and from Bridgeport and Swedesborough, there are a number of landings (marked on the maps) between both places, which are used as convenient shipping points.

Apart from a considerable fishing interest located at Bridgeport, the export of the river, as stated above, consists entirely of farm products, while the imports are principally building materials, manure, coal, and general commodities. This trade is carried by steamboats, sloops, and barges. During the fair season there are several steamers making regular daily trips between Philadelphia and the various points on Raccoon River, viz, Bridgeport, Davenport's Wharf, Springer's Wharf, and the steamboat landing at Swedesborough. Further details concerning the trade of the river will be found in a subjoined table.

The river is crossed by four bridges. Two of these, located at Bridgeport, are drawbridges and do not interfere with the navigation. The two others, located at Swedesborough, are both permanent; the lower of these, the Swedesborough Railroad Bridge, has a clear height of about 8 feet above high water, and barges can therefore pass under it to reach the piers and landings of Swedesborough immediately above; the upper one is the Main Street Bridge, and forms the head of navigation.

Up to Davenport's Wharf, which is about half way between the mouth and Swedesborough, there is an uninterrupted channel of 4½ feet at low water, which is quite sufficient to accommodate the shipping of the river. Here, however, the difficulties commence. In the vicinity of Springer's Wharf, immediately above Davenport's, the channel is blocked by small bars. Above these for about 2½ miles the water continues good, but thence up to Swedesborough, a distance of about 2 miles, the channel is narrow and tortuous and frequently interrupted by shoals. The heavier draught vessels trading on the river cannot therefore go up any farther than Davenport's or Springer's Wharf.

The local aims in regard to an improvement are expressed in a letter of Mr. John Ford, justice of the peace at Swedesborough, to Mr. Quien, as follows:

"The people who are interested in the improvement of the navigation of Raccoon Creek desire that the navigation be made more safe and less difficult for the same class of vessels that now trade on said creek, and the distance to the Delaware River shortened. They also desire that the creek should be made navigable for a larger class of vessels if it be found expedient to do so. This, we believe, can be done by removing some of the most prominent shoals and shortening some of the principal bends."

The heaviest vessels at present trading on the river draw from 6 to 7 feet when loaded. The attempt to make the river navigable for larger vessels, while not being called for by the conditions of the trade, would necessitate very extensive dredging, channel depths as low as 4 and 5 feet occurring in almost all parts of the river.

The cutting off of bends, thereby not only shortening the distance to the Delaware, but also lessening the dangers to shipping, certainly would be very desirable, notably so in two places, viz, one about half a mile above Bridgeport, and one about half way between Springer's Wharf and Swedesborough (marked "Horseshoe" on the map). But here the well-known difficulty of the cession of the required land is encountered. Inquiry on this point has failed to elicit a definite promise of cession. In view of this, and having in mind that the active interest in the improvement of the river appears to be limited to a very small circle, and that the holders of property along the banks may very probably, from their point of view, look unfavorably upon any contemplated shifting of the present water-way, and thus be entirely indisposed themselves to aid such intentions, it was not deemed advisable to introduce into the project of improvement an element carrying with it such uncertainties in regard to a vital point.

Of the local wishes, as expressed in Mr. Ford's letter, there remains "to make the navigation more safe and less difficult for the same class of vessels now trading in the creek." This can be done at a moderate expense by removing the above-mentioned shoals in the vicinity of and above Springer's Wharf, thus enabling the shipping to go up to Swedesborough.

The cutting of a channel of 4 feet depth at low water and 40 feet bottom width through the shoal at Springer's Wharf, and farther up from "Horseshoe" to the Swedesborough Railroad Bridge, would necessitate the removal of about 20,000 cubic yards of sand and mud. It is not believed probable that a contract for this work can be secured at much less than 60 cents per cubic yard, and basing an estimate on this figure the expense would stand thus:

Excavation up to Swedesborough Railroad Bridge of a channel 4 feet deep at low water, and 40 feet wide at bottom, 20,000 cubic yards, at 60 cents per cubic yard	$12,000
Contingencies and engineering, 15 per cent	1,800
Total	13,800

In view of the fact that the Swedesborough Railroad Bridge is permanent and only allows barges to pass under it and go up to the piers and landings of the town immediately above, it might perhaps appear proper that an improvement beyond this bridge, which would practically amount to a cleaning out of the Swedesborough pier line, should be left to the parties locally interested.

If, however, it is decided to extend the improvement to this part of the river, then the excavation of a channel of 3 feet depth and 40 feet bottom width there would require the additional removal of about 6,000 cubic yards of sand and mud, and the entire expense would now stand thus:

Excavation up to Swedesborough Railroad Bridge, as detailed above	$12,000
Excavation above Swedesborough Railroad Bridge of a channel 3 feet deep at low water and of 40 feet bottom width, 6,000 cubic yards, at 60 cents per cubic yard	3,600
Contingencies and engineering, 15 per cent	2,340
Total	17,940

In regard to the appended table of commercial statistics it should be mentioned that while the imports and exports of the entire river are given, the proposed improvement really has a bearing on those only to and from points above Bridgeport, up to which place the navigation is unobstructed and not in need of an improvement.

Respectfully submitted.

E. A. GIESELER,
Assistant Engineer.

General GODFREY WEITZEL,
Lieut. Col. of Engrs., U. S. A.

COMMERCIAL STATISTICS OF RACCOON RIVER.

1. *Imports to Bridgeport (annual):*

Bricks	$750
Building stone	375
Hay, 200 tons	1,200
Lumber, 600,000 feet	15,000
Coal, 800 tons	4,400
Lime, 500 tons	1,690
Manure, 20,000 cart-loads	22,000
Merchandise	10,000
Total	55,415

2. *Exports from Bridgeport (annual):*

Agricultural products	80,000
Total annual imports and exports to and from Bridgeport	135,415

3. *Imports to points above Bridgeport (annual):*

Bricks	$750
Building stone	1,050
Plaster stone	1,500
Manure, 35,000 cart-loads	36,500
Hay, 600 tons	3,600
Lumber, 800,000 feet	20,000
Coal, 1,200 tons	6,600
Lime, 1,500 tons	5,070
Grain, 7,000 bushels	4,410
Merchandise	10,000
Total	89,480

4. *Exports from points above Bridgeport:*

Agricultural products	80,000
Total annual imports and exports to and from points above Bridgeport.	169,480

RECAPITULATION.

Imports to Bridgeport	$55,415
Imports to points above Bridgeport	89,480
Total annual imports	144,895
Exports from Bridgeport	80,000
Exports from points above Bridgeport	80,000
Total annual exports	160,000
Total annual exports and imports	304,895

VESSELS TRADING ON THE RIVER.

Steamboats	5
Steam-tugs	2
Sloops	6
Barges	4

The above commercial statistics were furnished by Mr. John Ford, of Swedesborough.

G 24.

IMPROVEMENT OF INDIAN RIVER, DELAWARE.

By circular letter from the office of the Chief of Engineers, United States Army, dated Washington, D. C., August 8, 1882, I was informed that the sum of $10,000 had been appropriated for this work by the river and harbor act which passed August 2, 1882, and I was directed to submit a project for its expenditure. Subsequently I was ordered not to do any work under this appropriation, but the order was afterwards revoked.

The project which I submitted contemplated the commencement of the work by dredging the Bulkhead Shoal and, if the means permitted, to construct the dike described as "A" in the report of Capt. William Ludlow, Corps of Engineers, dated "Philadelphia, Pa., April 29, 1882," and which begins on page 828 of the Annual Report of the Chief of Engineers, United States Army, for 1882. This was approved, and on May 3, 1883, contract for the dredging was made with Mr. Frank C. Somers, of this city. Work was begun on June 7, 1882, and 2,476 cubic yards of material had been removed by the end of the last fiscal year.

If this work is carried on to completion the next appropriation should be, for various reasons, at least $35,000. It was estimated to cost $50,000, but on account of the dredging costing more than was anticipated, the probable cost will be about $60,000.

The annual report of Mr. Joseph N. Odiorne, the assistant in local charge of the work, gives additional information and the commercial statistics of the river.

This work is situated in the collection district of Delaware. The nearest port of entry is Wilmington, Del. The revenue collected there during the past fiscal year amounted to $33,098.52. The nearest fort is Fort Delaware, and the nearest lighthouse Cape Henlopen light.

Total appropriations to June 30, 1883	$10,000 00
Total expenditures to June 30, 1883	1,392 16

Money statement.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$537 94	
July 1, 1883, outstanding liabilities	854 22	
		1,392 16
July 1, 1883, amount available		8,607 84
Amount (estimated) required for completion of existing project		50,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		35,000 00

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on April 28, 1883, for improving Indian River, Delaware.

No.	Names and addresses of bidders.	Dredging.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	American Dredging Company, Philadelphia, Pa	$0 35	May 20, 1883	July 20, 1883
2	Frank C. Somers, Philadelphia, Pa	34¼	June 15, 1883	Oct. 15, 1883

Contract, dated May 3, 1883, awarded to Frank C. Somers; to be completed October 5, 1883.

REPORT OF MR. JOSEPH N. ODIORNE, ASSISTANT ENGINEER.

The examination of this stream was made in March, 1882, and the project for its improvement as a result of this examination was to dredge a channel 4 feet deep at low water and 80 feet wide through the "Bulkhead Shoal," to dredge a channel thence straight to the inlet, protecting this channel by a dike on its northern side through to the sea-beach, and the construction of a >-shaped dike at the northeast end of Burton's Island.

With the $10,000 appropriated by the act of August 2, 1882, preparations were made in March, 1883, for dredging the "Bulkhead Shoal." Proposals for dredging were opened April 28, 1883, and contract was made with Frank C. Somers, May 3, 1883. Work under this contract was begun June 7, 1883, and up to June 30, 1883, 2,476 cubic yards of material have been removed. The work is now in progress, and will probably be completed by September 15, 1883.

The price of dredging (34½ cents) being considerably above that of the original estimate, all of the present appropriations will be required to complete the Bulkhead Channel.

In the event of future appropriations being made for the channel to the inlet, a sum of not less than $35,000 should be appropriated, and this in one sum, as the dike should be constructed and the channel dredged through in one season to render the improvement permanent. When the Bulkhead Channel is completed, the navigation of the river will be greatly relieved, as the greatest delays are now incurred on the Bulkhead and all cargoes are transferred to lighters before vessels can cross. The commercial statistics, as near as could be ascertained, are appended.

Respectfully submitted.

JOS. N. ODIORNE,
Assistant Engineer.

COMMERCIAL STATISTICS FOR INDIAN RIVER, DELAWARE.

The commerce of this stream consists of nine vessels of from 10 to 50 tons each, making from ten to twenty trips per year, and about ten trips per year are made by transient vessels. About fifty saw-mills are operated along the river and its tributaries, but owing to the difficulties of navigation but a small part of the lumber sawed is shipped by water.

Indian River flows through a fine agricultural region where large quantities of wheat and corn are raised, but the same remark as to shipping applies to these as to the lumber. A large oyster traffic is carried on, which is rapidly increasing, owing to the favorable conditions for planting.

EXPORTS.

1,250,000 feet oak and pine lumber	$25,000
30,000 bushels wheat	30,000
50,000 bushels corn	25,000
1,000 cords wood	3,000
Total	83,000

IMPORTS.

5,000 bushels lime	$450
7,000 bushels oysters for plants	1,050
500 tons fertilizers	12,500
General merchandise	75,000
Total	89,000

G 25.

IMPROVEMENT OF THE NORTH BRANCH OF SUSQUEHANNA RIVER, PENNYLVANIA.

The river and harbor act which passed August 2, 1882, made an appropriation of $15,000 for continuing this improvement.

The same act ordered a survey of the river from Pittston to Athens. I was authorized to pay for this survey from the above-mentioned appropriation and to expend the balance in continuing the improvement up stream.

The annual report of the assistant in local charge, Mr. John H. Dager, gives full details of the operations during the past fiscal year.

Total appropriation to June 30, 1883	$45,000 00
Total expenditures to June 30, 1883	37,961 32

Money statement.

July 1, 1882, amount available		$5,255 38
Amount appropriated by act passed August 2, 1882		15,000 00
		20,255 38
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$11,772 80	
July 1, 1883, outstanding liabilities	1,414 20	
		13,187 00
July 1, 1883, amount available		7,068 38
Amount (estimated) required for completion of existing project		205,000 00

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on April 18, 1883, for improving the North Branch of the Susquehanna River, Pennsylvania.

No.	Name of bidder.	Dredging.	Dikes complete.	Rock backing in place.	Date of completion.
		Per cu. yard.	*Per run. foot.*	*Per cu. yard.*	
1	Robert C. Mitchell, Plainsville, Pa.....	$0 75	$8 00	$2 00	Sept. 1, 1883

Contract, dated April 30, 1883, awarded to Robert C. Mitchell; to be completed September 1, 1883.

REPORT OF MR. JOHN H. DAGER, ASSISTANT ENGINEER.

WILMINGTON, DEL., *July* 6, 1883.

GENERAL: I have the honor to submit the following report on the improvement of the Susquehanna River, above Richard's Island, Pennsylvania, for the fiscal year ending June 30, 1883.

During the year 5,433 cubic yards of gravel were dredged from the Forty-Fort Shoal, completing a 60-foot-wide channel 4 feet in depth, and 927 yards of rock were blasted and removed from Hillman's Ripple, completing the work thereat. Each of these were under the second contract for the improvement of this river.

Hillman's Ripple is a rocky anticlinal extending from the south shore in a westerly direction across the river, falling slightly as it leaves the shores, presenting a barrier to the stream of an average width of 200 feet. A passage 60 feet in width, and giving 4 feet draught, was blasted through this ledge.

Since the improvements under the first appropriation were made, and which were ample to accommodate the vessels at that time running on the river, there has been an addition to their number, which draws more water than was desired and secured. Consequently, a revised project was made for opening a channel 4 feet deep at low water, which is now in course of construction, and which will be obtained at comparatively small expense, as only a lengthening of the cuts made during the season of 1880 will be necessary.

The act of Congress dated August 2, 1882, appropriated $15,000 toward the improvement of this river, a portion of which was applied to making a survey of it from Pittston to Athens, Pa., the balance to be used in deepening the existing channel at shoal places between Plymouth and Wilkes-Barre, and to the modification of the water slope at the Gas House Riff, by constructing parallel training-walls at the foot of the slope.

The Gas House Riff is three-quarters of a mile above the Wilkes-Barre Bridge. Prior to the improvement of 1881 it was a shoal gravel bar connecting the south shore of the river with a large shoal in the center of the river, exposed at low water, and at which the water fell 2.74 feet in a very short distance. This fall had been slightly extended by the dredging, but not sufficiently. Training-walls for a further reduction of this slope are necessary, otherwise the present line of steamboats will be unable to pass up this incline.

The survey was made during the fall months of 1882. A separate report has been filed thereon.

A contract was made April 30, 1883, for the dredging and diking. The former was commenced about the middle of May, and up to June 30 there had been removed 3,071 cubic yards from the several points at the head and foot of the former dredged channels at Richard's and Wilkes-Barre Island. It is expected to complete the contract by September 15 proximo.

Active operations on works on this river are confined to a limited time during a year for several reasons, viz: The winters are long and generally severe. Fluctuating stages of water, successive freshets producing too strong a current for handling material without steam-propelling power, of which there is none to be had, &c.

Measurement for the discharge made in September, 1881, at the head of Wilkes-Barre Island, when the water on the Wilkes-Barre Bridge pier gauge registered 1 foot 5¾ inches below zero (the lowest of the season and 8 inches lower than the record of the previous season), gave a mean of 799 cubic feet per second. This at the present time would be increased by an amount then drawn from the Lackawanna River by a feeder used to maintain the Wilkes-Barre section of the Pennsylvania canal, which has since been abandoned.

It may here be appropriate to give a synopsis of former attempts to improve the natural bed of this river. A few years ago some improvement was made to the navigation of the stream between Plymouth and Wilkes-Barre by the Wright Steamboat Company by deepening through the shoals and putting in cricket dams, directing the flow of water to single courses where more had existed. Between $3,000 and $4,000 were thus expended.

An act of Congress passed June 14, 1880, appropriated $15,000 for the improvement of the Susquehanna River above Richard's Island, Pa., which was expended in making a survey of the same between this island and Pittston, in dredging to deepen the natural channel at shoal places between Richard's Island and Wilkes-Barre, and in constructing a dike connecting the head of Wikes-Barre Island with the north shore for the purpose of conveying the entire low-water flow through the improved south passage thereat.

By act dated March 3, 1881, $15,000 additional were appropriated for further improvements, under which the following was accomplished, viz: Building a brush and gravel dike between the north shore and the middle ground at the Gas House Riff; dredging a channel through this riff; blasting a channel through the rock bottom at Hillman's Ripple, and dredging through the Forty-Fort Shoal.

In addition to this, Congress granted a further amount of $15,000, the expenditure of which has been heretofore mentioned.

In a commercial point of view, this river has no standing excepting the rafting of timber, which is becoming more limited every year, the small amount of agricultural products which find their way by water to the mining regions, and the passenger travel on that part which has been improved.

It is believed there is nothing more to present than the following:

COMMERCIAL STATISTICS.

Three steamboats ply regularly between Nanticoke and Wilkes-Barre, averaging four round trips daily for the season of seven months, carrying in the aggregate 70,000 passengers, besides a very limited amount of freight.

There are annually brought down the river in flats 10,000 bushels of potatoes and 3,000 of corn from the agricultural regions above.

The estimated quantity of lumber descending by raft is as follows:

Logs	500,000 linear feet.
Sawed lumber	2,000,000 feet B. M.

An extensive merchandising business is carried on throughout the Wyoming Valley, which cannot be tabulated nor the value inferred. The manufacturing industries of this region compare favorably with those of any other section of the State.

I am, general, very respectfully, your obedient servant,

JOHN H. DAGER,
Assistant Engineer.

General G. WEITZEL,
Lieut. Col. of Engineers, U. S. A.

G 26.

CONSTRUCTION OF IRON PIER IN DELAWARE BAY, NEAR LEWES, DELAWARE.

The river and harbor act which passed August 2, 1882, appropriated $13,000 for continuing this work. Its history during the past fiscal year is fully set forth in the annexed copy of the report of the assistant in local charge, Mr. J. M Stewart.

It is estimated that $12,000 will place it in good order, and I recommend that this appropriation be made for the fiscal year ending June 30, 1885.

It is situated in the collection district of Delaware, the nearest port of entry being Wilmington, Del., at which the revenue collected during the past fiscal year amounted to $33,098.52. The nearest fort and light-house are, respectively, Fort Delaware and the Breakwater light.

Total appropriations to June 30, 1883	$368,500 00
Total expenditures to June 30, 1883	362,732 81

Money statement.

July 1, 1882, amount available	$1,274 05	
Amount appropriated by act passed August 2, 1882	13,000 00	
	14,274 05	
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	8,506 86	
July 1, 1883, amount available	5,767 19	
Amount (estimated) required for completion of existing project	12,000 00	
Amount that can be profitably expended in fiscal year ending June 30, 1885.	12,000 00	

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on October 12, 1882, for material for United States pier near Lewes, Del.

No.	Names and addresses of bidders.	91,380 feet yellow pine lumber.
		Per M feet.
1	W. A. Levering, Philadelphia, Pa	$48 50
2	Eppinger & Russell, New York City	27 25
3	W. V. Case Lumber Company, Philadelphia, Pa	28 50
4	J. W. Gaskill & Sons, Philadelphia, Pa	44 00

Contract awarded to Eppinger & Russell; dated October 25, 1882.

REPORT OF MR. J. M. STEWART, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Lewes, Del., July 7, 1883.

SIR: I have the honor to submit the following report upon the construction of the iron pier in Delaware Bay near Lewes, Del., for the fiscal year ending June 30, 1883.

At the close of the last fiscal year mention was made of the decayed condition of the timber in the superstructure. In the previous year $19,000 was asked for to replace it and for the purpose of laying the railroad track as provided for in the original plan. Thirteen thousand dollars of this amount was appropriated by act of August 2, 1883. With this it was proposed to replace the worst of the decayed stringers, cross-beams, floor-joists, &c., and to lay the railroad track so that the pier might be put to some practical use while waiting further appropriations to complete it.

A contract was made with Messrs. Eppinger & Russell, of New York, in October, 1882, for 92,343 feet of yellow pine lumber, which was delivered in the following February, but, owing to the great amount of sap in the large stringers, it was found necessary to reject almost all of them.

Work was commenced in the latter part of February, with such of the material as was suitable, and carried on until April 1, when a suspension was caused by the slowness of the contractors in replacing the rejected stringers. Work was resumed on May 28, and has since been vigorously pushed, and up to June 30 500 feet, or the entire wide part of the pier, was torn up and the decayed timbers replaced by fifty new stringers, twenty-eight cross-beams, and one hundred and seventy floor-joists. Of the bolts in this 500 feet all had to be worked over and the threads recut.

The railroad iron for laying one main track the entire length of the pier, and two sidings on the wide part, with the necessary spikes, fish-plate joints, &c., and two safety-switches, were purchased and delivered on April 18.

It was expected that the $19,000 asked for in the report of 1881 ($13,000 of which has been appropriated, as already mentioned) would be sufficient to complete the entire pier. A recent examination, however, shows that the superstructure of almost the entire narrow part of the pier has so deteriorated that it will be necessary to replace it. The engineer in charge at that time noted this deterioration and in his examination marked stringers, cross-beams, &c., to be taken out, but in going over it now it is found necessary to more than double the number then marked; in fact, the entire superstructure from the abutment to the fifty-fourth bay will have to be renewed. The lumber purchased some years ago for decking the pier has been piled upon the beach in the sand so long that it is worthless. An estimate based upon this examination will require $12,000 to complete the pier.

The state of the pier at this date is as follows: The wide part or from the fifty-fourth to the eighty-first bay, inclusive, is completed, except the decking and laying the railroad tracks; the narrow part is just as it was last year.

The pier, when completed, will be of great service to shipping and to vessels resorting to this harbor for refuge, affording them the means of shipping supplies of coal, cordage, spars, chains, provisions, &c. A new railway is in course of construction looking to the pier as a terminus, a large coal depot is in contemplation and talk of grain elevators, &c., when the pier and harbor improvement are completed. When the "Gap" between the ice breaker and breakwater is closed this will be one of the safest harbors on the Atlantic coast, and during the winter when vessels cannot get to

Philadelphia or Baltimore, they can run in here and take cargo from the pier. They can at any time save at least four days' time and the heavy port charges of those cities.

Respectfully submitted.

J. M. STEWART,
Assistant Engineer.

Lieut. Col. G. WEITZEL,
Corps of Engineers, U. S. A.

G 27.

IMPROVEMENT OF DELAWARE BREAKWATER HARBOR, DELAWARE.

The history of all that has been done at this work during the last fiscal year is fully set forth in the annexed report of the assistant in local charge of the work.

The sum of $125,000 to begin it was appropriated by the act of Congress which passed August 2, 1882.

I received authority to purchase the material required by contract, and to construct the plant and do the preliminary work by hired labor.

The contractors for lumber, bolts, nuts, washers, spikes, and railroad iron fulfilled their agreements promptly, but the contractors for creosoted piles, railroad ties, brush, and granite have delayed our operations very much by not fulfilling their agreements on time. This, may, however, prove a benefit to the work in the end.

The lowest bidder for granite at the first letting declined to enter into contract, and it was readvertised.

The amount to be appropriated to complete this work is estimated at $550,000. Of this sum $250,000 could be profitably expended during the fiscal year ending June 30, 1885.

This work is situated in the collection district of Delaware, the nearest port of entry being Wilmington, Del., at which the revenue collected during the last fiscal year amounted to $33,098.52. Fort Delaware is the nearest fort, and the Breakwater light the nearest light-house.

Money statement.

Amount appropriated by act passed August 2, 1882		$125,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$17,379 35	
July 1, 1883, outstanding liabilities	59,322 40	
		76,701 75
July 1, 1883, amount available		48,298 25
Amount (estimated) required for completion of existing project		550,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		250,000 00

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, October 25, 1882, for materials for Delaware Breakwater Harbor.

No.	Names and addresses of bidders.	First class: Yellow pine or white oak lumber, 123,278 feet, B. M.	Second class: 264 piles, creosoted=216,900 feet, B. M.		Total.	Third class.					Fourth class.				Fifth class: 40 tons railroad iron, 30 lbs. per yard.	Sixth class.		Seventh class: 16,225 tons granite.
						1,672 pounds bolts and nuts.	3,960 pounds bolts and nuts.	1,150 pounds washers.	12,320 pounds tie-rods.	Total.	1,400 pounds flooring spikes.	500 pounds No. 60 spikes.	2,400 pounds railroad spikes.	Total.		1,200 oak railroad ties.	15,000 cubic yards brush.	
		Per M feet.	*Pr. M feet.*	*Per pile.*		*Pr. lb.*	*Pr. lb.*	*Pr. lb.*	*Pr. lb.*		*Pr. lb.*	*Pr. lb.*	*Pr. lb.*		*Pr. ton.*	*Per tie.*	*Pr. cu. yd.*	*Per ton.*
1	W. V. Case Lumber Company, Philadelphia, Pa	$28 50 y. p.														$0 50		
*a*2	Albert L. Burten, Lewes, Del	32 50 w. o.														49	$1 41	
3	Samuel R. Cumming, New York	26 75 y. p.	$56 00		$12,146 40	$0 4½	$0 4½	$0 4½	$0 4½	$859 59	$0 4½	$0 4½	$0 4½	$193 50	$50 00	65	1 25	$1 62½
*b*4	Eppinger & Russell, New York	24 25 y. p.		1. $73 50 2. 63 50 3. 79 50	19,404 00 16,764 00 20,988 00													
5	Robert Arnell, Lewes, Del	35 00 w. o.																
6	John Baizley, Philadelphia, Pa	38 00 y. p.				6¾	6½	7	5¼	1,098 31	4¾	4¾	4⅝	191 05	54 50	1 50		
7	Finley, Garrett & Wilson, Wilmington, Del					4⅛	4⅛	4⅛	4⅛	787 96								
*c*8	Fred'k K. Ballou, Boston, Mass					4½	4½	4½	4½	859 59	4½	4½	4½	193 50				4 33
9	Paul J. Field, Philadelphia, Pa										3 9/10	4⅕	3½	159 60	49 00			
10	Leiper, Lewis & Ward, Chester, Pa																	4 49
11	John Jamson, Milford, N. J																	4 49
*d*12	Conshohocken Stone Quarry Company, Philadelphia, Pa																	4 05
*e*13	Chas. H. Edwards, Quincy, Mass																	5 00
*f*14	Mount Waldo Granite Company, Frankford, Me																	6 47
15	McClanahan Bros., Port Deposit, Md																	5 40
16	James M. Andrews, Biddeford, Me																	3 75

a Bids not accompanied by specifications.

b { 1. If to be delivered within 40 days.
2. If delivery can be deferred until March, 1883.
3. If piles are to be made up of 6″ × 12″ or equal sizes.

c Sureties not certified to.
d "Bidder's bond" not filled up or signed and no sureties given.
e No sureties given.
f Bids in duplicate only.

Abstract of contracts for materials for Delaware Breakwater Harbor.

Names and addresses of contractors.	First-class: Yellow-pine lumber, 123,278 feet, B. M.	Second class: 264 piles, creosoted, = 216,900 feet, B. M.		Third class: 5,632 lbs. bolts and nuts; 1,150 lbs. washers; 12,320 lbs. tie-rods.		Fourth class.				Fifth class: 40 tons railroad iron, 30 pounds per yard.	Sixth class.		Date of contract.
		Per M feet.	Total.	Per lb.	Total.	1,400 pounds flooring spikes.	500 pounds No. 60 spikes.	2,400 pounds railroad spikes.	Total.		1,200 oak railroad ties.	15,000 cu. yds. brush.	
	Per M feet.					*Per lb.*	*Per lb.*	*Per lb.*		*Per ton.*	*Per tie.*	*Per cu. yd.*	
Eppinger & Russell, New York	$24 25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Dec. 27, 1882
Samuel R. Cumming, New York	.....	$56 00	$12,146 40	.....	.....	.....	.....	.....	.....	.....	$0 65	$1 25	Jan. 6, 1883
Finley, Garret & Wilson, Wilmington, Del	.....	.....	.....	$0 04⅛	$787 96	.....	.....	.....	.....	.....	.....	.....	Nov. 10, 1882
Paul G. Field, Philadelphia, Pa	.....	.....	.....	.....	.....	$0 03 9/10	$0 04⅛	$0 03⅛	$159 60	$49 00	.....	.....	Nov. 9, 1882

Abstract of proposals received and opened by Lieut. Col. G. Weitzel, Corps of Engineers, on January 27, 1883, for granite for Delaware Breakwater Harbor.

No.	Names and addresses of bidders.	Rate.
		*Per ton.**
1	Jas. M. Andrews, Biddeford, Me	$3 50
2	Francis H. Smith, New York, N. Y	3 23
3	John Beattie, Leete's Island, Conn	3 25
4	Mount Waldo Granite Works, Frankford, Me	5 42
5	Ellsworth & E. Blue Hill Granite Company, Ellsworth, Me	5 97
6	William H. Brown, Brooklyn, N. Y	3 23
7	Leepier, Lewis & Ward, Chester, Pa	4 23
8	George G. Leepier, Chester, Pa	3 42
9	Conshohocken Stone Quarry Company, Philadelphia, Pa	4 35

*2,240 pounds.

Contract awarded to William H. Brown; dated February 12, 1883.

REPORT OF MR. J. M. STEWART, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Lewes, Del., July 7, 1883.

SIR: I have the honor to submit the following report upon the work of "improving the Delaware Breakwater Harbor," for the fiscal year ending June 30, 1883.

The Breakwater Harbor for many years fulfilled, so far as its capacity enabled it, the design of its projectors in protecting the commerce of the country; but the growth of this commerce, particularly during the last twenty-five years, has so far exceeded possible anticipation as to practically exclude far more than a fractional part from the intended shelter. At various times, therefore, projects looking to the enlargement of the protected area have been the subject of deliberation by officers and Boards of Engineers; and in 1881 the matter received renewed attention from the reference, by the Chief of Engineers, United States Army, to a report of Maj. William Ludlow, Corps of Engineers, which, by the comparison of a recent with former surveys, showed that not only was the protected area yearly diminishing relatively to the amount of shipping seeking shelter, but was also undergoing a positive and serious deterioration from a marked decrease in depth. In view of this a Board of Engineers recommended, as a possible remedy, the closing of the "Gap" existing between the breakwater proper and the adjoining ice-breakwater.

A project for this work was prepared and approved, and by act of August 2, 1882, an appropriation of $125,000 was made for commencing operations. With this money it was proposed to sink a brush mattress across the gap, to prevent scouring of the bottom by the currents, to drive piles and erect a bridge, and to fill the gap, so far as the appropriation would permit, with granite blocks.

In September, 1882, a careful survey was made and borings taken, after which specifications were prepared and contracts for furnishing the various materials were let in October following.

It being desired to make an early commencement, the preparation of a plant was at once begun.

A lighter was built by day's labor, a derrick and pile-driver were erected, and a wharf built on the ice-breaker. The lighter was made to propel itself by placing on it a hoisting engine which connected with a paddle-wheel at the stern. By means of this engine and an endless chain, a railroad track was laid on the ice-breaker to facilitate the moving of heavy material and to carry out and put in place the large stone.

Owing to the very great slowness of the contractor, Mr. S. R. Cumming, of New York, in delivering brush for the mattresses and creosoted piles for the bridge, the work has been very materially delayed and the contingent expenses increased. He has delayed the work until the season has become so far advanced that it is now considered advisable to postpone the commencement of actual operations until next spring, by which time it is expected all the materials will have been delivered.

The importance of this work is such that sufficient appropriations should be made to allow of its completion as soon as possible.

The shoals at the point of the cape which are making year by year render this absolutely necessary.

During the fiscal year just ended, 7,647 vessels, seeking shelter from storms, anchored in the harbor, and during the winter months there were so many in it at one time as

to make it unsafe, as when swinging with the tide they were in danger of striking one another.

It is proposed during the coming season to build the bridge, sink mattresses across the entire gap, and to fill in with granite to the extent of the available funds.

The estimated cost of the work is $675,000.

Amount appropriated August 2, 1882	$125,000
Amount necessary to complete the work	550,000

Respectfully submitted.

J. M. STEWART,
Assistant Engineer.

Lieut. Col. G. WEITZEL,
Corps of Engineers, U. S. A.

G 28.

REMOVAL OF WRECKS FROM DELAWARE BREAKWATER HARBOR, BAY, AND RIVER.

During the past fiscal year I have been directed to remove the wreck of the schooner Trade Wind, which lies in the channel about 1⅓ miles southwest-by-west from East Point light, and in the track of vessels entering and leaving Maurice River, New Jersey. Proposals to do this have been advertised for.

I have also been ordered to remove the wreck of a sand-boat, which lies in the middle of the eastern channel about 300 feet above the mouth of the Delaware and Raritan Canal.

Money statement.

July 1, 1882, amount available	$5,289 47
July 1, 1883, amount available	5,289 47

G 29.

REMOVING SUNKEN VESSELS OBSTRUCTING OR ENDANGERING NAVIGATION.

The wreck of the Cassandra, on Brigantine Shoals, coast of New Jersey, having been removed, as mentioned in last Annual Report, payment was made to the contractors on August 25, 1882.

The net proceeds of the sale of the wreck were $367, which were turned into the United States Treasury.

G 30.

PORT WARDEN'S LINE, PHILADELPHIA, PENNSYLVANIA.

The history of all that has been done by the United States Commissioners Advisory to the Board of Harbor Commissioners during the past fiscal year is set forth in the annexed report of the secretary, First Lieut. Thomas L. Casey, Corps of Engineers, U. S. A.

The Port Warden's lines on the Schuylkill River have finally been agreed upon, and those on the Delaware River in front of the city of

Philadelphia are now under discussion and study. These lines have been established from the Schuylkill River to Frankford Creek by the Pennsylvania legislature. They are objectionable in some respects, and it will be a matter of some difficulty to readjust them, as some structures are already built out to them, others are in course of construction, and yet others again under contract to be carried to those lines.

REPORT OF LIEUTENANT THOMAS L. CASEY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., June 30, 1883.

SIR: As secretary to the Commission Advisory to the Board of Harbor Commissioners of Philadelphia, I have to report as follows:

During the fiscal year ending June 30, 1883, there were five meetings of the Commission, four of which were formal and held since my return from detached service April 29, 1883. The first was an informal meeting, held March 4, between Captain White and Professor Mitchell, for the purpose of agreeing upon a chairman. Since this date the Commission has been organized as follows: Lieut. Col. Godfrey Weitzel, Corps of Engineers, chairman; Capt. G. B. White, U. S. Navy; Prof. Henry Mitchell, U. S. C. and G. S.; First Lieut. T. L. Casey, Corps Engineers, secretary.

Mr. H. L. Marindin, Assistant, United States Coast and Geodetic Survey, was before the Commission for the purpose of reading an essay on a system of harbor lines from Red Bank, N. J., to Cooper's Point, and imparting to the same such other information as might be desired.*

The first formal meeting was held at 1125 Girard street on May 8, and was of a purely scientific nature.

Mr. Marindin read the above-mentioned paper which was formally accepted by the Commission as embodying its conclusions on the subject, and Professor Mitchell read two papers upon the method of shoaling and the treatment of the channels about Petty's Island.

The second meeting was held at the office of Mr. Smedley, city engineer, on May 9, and was for the purpose of investigating the harbor lines of New Jersey, the city's lines for the Delaware and Schuylkill rivers, and of making comparisons between these and the lines of the Advisory Commission, and also for general discussion.

The third meeting was held May 10, at the building of the Insurance Company of North America, simultaneously with a meeting of the Harbor Commissioners, the chairman of the Board of Port Wardens also being present.

The views of the Advisory Commission were here given by Mr. Marindin, who read his paper on the subject. The Harbor Commissioners desired about a week to examine into the subject, at which time a joint meeting might be held, when their views could be delivered.

The fourth meeting was held May 22, at the same place as the preceding. The Harbor Commissioners were represented by very few members and the Board of Port Wardens by its chairman only. No conclusion was reached, but as the lines proposed by the Commission curtail several of the wharves as they at present exist, it was thought best to state in the newspapers that the plans would be subject to inspection by injured parties, at the office, 1125 Girard street, which was accordingly done. The two bodies then adjourned *sine die*.

Nothing further has been done except by Mr. Marindin, who has extended his system to Five-Mile Point, Pennsylvania.

Very respectfully, your obedient servant,

THOS. L. CASEY,
First Lieutenant of Engineers.

Lieut. Col. GODFREY WEITZEL,
Corps of Engineers, U. S. A.,
Chairman of Commission.

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* Mr. Marindin was, at the second meeting, elected consulting engineer of the Commission.

APPENDIX H.

IMPROVEMENT OF HARBORS AND RIVERS ON EASTERN SHORE OF CHESAPEAKE BAY AND OF THE SUSQUEHANNA AND PATAPSCO RIVERS IN MARYLAND; OF BROAD CREEK, DELAWARE; OF JAMES AND APPOMATTOX RIVERS AND ONANCOCK HARBOR, VIRGINIA; OF GREAT KANAWHA, ELK, AND SHENANDOAH RIVERS, WEST VIRGINIA; OF NEW RIVER, VIRGINIA AND WEST VIRGINIA; AND OF CAPE FEAR RIVER, NORTH CAROLINA.

REPORT OF LIEUTENANT-COLONEL WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1883, *WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

1. Susquehanna River, near Havre de Grace, Md.
2. Northeast River, Maryland.
3. Elk River, Maryland.
4. Chester River, Maryland, from Spry's Landing to Crumpton.
5. Corsica Creek, Maryland.
6. Chester River, at Kent Island Narrows, Maryland.
7. Harbor at Queenstown, Md.
8. Improving channel to Baltimore, Md.
9. Harbor of Annapolis, Md.
10. Choptank River, between Denton and Greensborough, Md.
11. Secretary Creek, Maryland.
12. Harbor of Cambridge, Md.
13. Threadhaven Creek, Maryland.
14. Water passage between Deal's Island and Little Deal's Island, Lower Thoroughfare, Md.
15. Upper Thoroughfare; between Deal's Island and the mainland.
16. Broad Creek, Delaware, from its mouth to Laurel.
17. Wicomico River, Maryland.
18. Pokomoke River, Maryland.
19. Onancock Harbor, Virginia.
20. James River. Virginia.
21. Appomattox River, Virginia.
22. Shenandoah River, West Virginia.
23. New River, from the mouth of Wilson, in Grayson County, Virginia, to mouth of Greenbrier River, West Virginia.
24. Great Kanawha River, West Virginia.
25. Elk River, West Virginia.
26. Cape Fear River, North Carolina.
27. Removing sunken vessels obstructing or endangering navigation.

SURVEY.

28. For ship-canal to connect Chesapeake and Delaware bays.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., July 14, 1883.

GENERAL: I have the honor to forward herewith the annual report for the year ending June 30, 1883, for works of improvement of rivers and harbors and of surveys which have been in my charge.

Efforts have been made to procure full commercial statistics, but have not been as successful as desired.

Very respectfully, your obedient servant,

WM. P. CRAIGHILL,
Lieutenant-Colonel of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

H 1.

IMPROVEMENT OF THE CHANNEL OF THE SUSQUEHANNA RIVER ABOVE AND BELOW HAVRE DE GRACE, AND TO COMPLETE THE WORK AT THE FISHING BATTERY LIGHT STATION, NEAR SPESUTIE ISLAND.

An appropriation of $25,000 was made by the act of August 2, 1882, of which the phraseology was as follows:

Improving Susquehanna River above and below Havre de Grace, Maryland, twenty-five thousand dollars, of which sum seven thousand five hundred dollars shall be expended above the bridge, and five thousand dollars for the completion of the channel to the Fishing Battery Light-house, and for strengthening and extending the piers and breakwater for the protection of said channel.

In order to determine with precision the proper locations above and below Havre de Grace at which to expend with the best results the limited sums available, it was found necessary to make a careful resurvey of portions of the river. This survey was at once undertaken, and being vigorously prosecuted, was finished in October, 1882. As soon as the map was ready, from which the location of the proposed dredging and regulating works could be determined, a call was made for proposals for certain dredging, to be received March 27, 1883. These were for excavating channels at the shoal between the railroad bridge and Port Deposit, in the channel between Spesutie Island and Havre de Grace light, and at the basin of the Fishery Station below Havre de Grace. The object of the work above the bridge was to facilitate the outflow of ice and to prevent dangerous gorging. The contract was assigned to the lowest bidder, the American Dredging Company of Philadelphia, at 19½ cents per cubic yard for material excavated and redeposited. The contract required the work to be completed in the year 1883, the extent of it being about 50,000 cubic yards of material, chiefly alluvium and compact sand. Some protection supposed to be needed for the cribs at the entrance of the Fishery Basin was given in December, 1882, by an enrockment, which was again somewhat increased in April. The dredging would have commenced in the spring, but was deferred to avoid interference as much as possible with the fishing at that season for shad and herring.

Continued study was given to the location of jetties for regulating the flow of the water with a view to permanence of depth in the channel, experience on this river, as in most other cases, having shown, as had been set forth in more than one previous report, that dredging gives but temporary relief to navigation. This study, for which the data were better than at any time before, resulted in a project for these jetties or regulating works at a cost of $100,000.

It was found that the cost of the survey and the dredging indispensable for present relief would absorb $18,500 of the $25,000 available. As the small remaining balance of $6,500 could not be usefully expended in jetties, and would materially increase the immediate improvement of navigation by dredging, it was decided to expend it chiefly in dredging, a small portion to be devoted to giving a better circulation of the water in the Fishery Basin and providing a platform for the nets.

Though, as has been more than once stated, the use of jetties or regulating works is positively indispensable to permanence of channel, and a dredged channel here will certainly fill up in one or two years, so much objection is made by the large capital and population interested in the fisheries, to the placing of the regulating works, as they would certainly interfere seriously with the nets, it is a question for Congress

to decide whether at once to appropriate money enough, $100,000, for these regulating works, to be put in to the detriment of the fishery interest, or to appropriate $20,000 annually for dredging.

The estimate herewith presented includes $100,000 for jetties and $20,000 for dredging, as this will probably be necessary once more before the jetties can be built, even if money be provided for them. It should also be borne in mind that injuries to the jetties from floating ice may be annually expected unless they be built in a very costly manner, and that an annual appropriation of $10,000 may be necessary to keep the jetties in order, and to build and maintain beacons and lights upon them.

Money statement.

July 1, 1882, amount available		$167 54
Amount appropriated by act passed August 2, 1882		25,000 00
		25,167 54
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$6,431 29	
July 1, 1883, outstanding liabilities	23 01	
		6,454 30
July 1, 1883, amount available		18,713 24
Amount (estimated) required for completion of existing project		120,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		120,000 00

Abstract of proposals for dredging in Susquehanna River, opened at 12.5 p. m., March 27, 1883.

No.	Names and addresses of bidders.	Date of commencement.	Date of completion.	Price.
				Per cu. yd.
1	Thomas P. Morgan, Washington, D. C			$0 20
2	Daniel Constantine, Baltimore, Md		Dec. 31, 1883	23
3	American Dredging Company, Philadelphia, Pa			19½
4	Frank C. Somers, Philadelphia, Pa	June 1, 1883	Oct. 15, 1883	23½

Contract with American Dredging Company.

COMMERCIAL STATISTICS OF SUSQUEHANNA RIVER—HAVRE DE GRACE, LAPIDUM, AND PORT DEPOSIT.

[Furnished through the courtesy of Hon. E. H. Webster, collector of the port of Baltimore.]

Received at Havre de Grace by the tide-water canal: Coal, 250,500 tons; lumber, 11,000,000 feet; grain, 15,000 bushels; ice, 150,000 tons; sundries, 20,000 tons. All of the above is transferred by canal-boats and barges without breaking bulk at Havre de Grace. Transferred and shipped by schooners and sloops; Coal, 130,000 tons; lumber, 6,000,000 feet; sand for bricks, 12,000 tons. Some of the vessels employed in this trade are small; it is estimated the above would make about 1,200 cargoes. Received and shipped at Lapidum, fertilizers and grain, 6,000 tons; Port Deposit, hay and straw, 9,500 tons; ice, 60,000 tons; lumber, 7,500,000 feet; grain, 5,500 tons.

VALUE AND AMOUNT OF WATER-BORNE TRADE FROM PORT DEPOSIT AND HAVRE DE GRACE, MARYLAND.

Port Deposit.

[Furnished by J. A. Davis, & Co.]

	Value.
Hay and straw, 10.000 tons	$150,000
White-pine lumber, 7,000,000 feet	140,000
Ice, 60,000 tons	180,000
Wheat and corn, 200,000 bushels	200,000
Oats and potatoes, 7,000 bushels	9,000
Stone, 72,000 tons	154,000
Total, 228,000 tons	833,000

Havre de Grace.

[Furnished by T. Wilson, and Hiller & Co.]

General merchandise, 60,000 tons; value, about	$1,200,000
Coal, 291,000 tons; value, about	1,100,000
Total, 351,000 tons	2,300,000

H 2.

IMPROVEMENT OF NORTHEAST RIVER, MARYLAND.

Operations at this place were closed in April, 1881, according to the plan fully explained in the Annual Report for 1881. There has been no appropriation since.

Nothing was done in the fiscal year ending June 30, 1883.

H 3.

IMPROVEMENT OF ELK RIVER, MARYLAND.

At the close of work under the appropriation of 1881, which was exhausted in December, 1881, there was a channel 60 feet wide and 8 feet deep at mean low water from the bridge at Elkton to a point about 1 mile below; a small bar just below this point had also been removed, and the channel was widened into a turning basin at a short distance below the bridge, and so the channel remained substantially June 30, 1882.

An appropriation of $6,500 was made August 2, 1882. The condition continued to be such that no expenditure was deemed necessary until in January, 1883, when the old dike was found to be so decayed as to require renewal or removal. This dike had originally been built as a bulkhead behind which dredged material might be conveniently placed, and thus prevented from going back into the channel, as well as to contract the water-way. It had always been expected this longitudinal dike of timber would decay at or near the water-line, and must then be renewed or removed, or the earth behind it, having had time for consolidation, be sloped back and formed into a new bank for the stream. It had been found, also, that vessels use the piles of a timber revetment to fasten their lines upon, and frequently pull them over and make a hurt-

ful obstruction. It was concluded, therefore, to remove the old dike and slope back the bank, which was done in March, 1883, the weather having previously been unfavorable.

A resurvey of the river having been made later, it was found that more dredging was necessary to give sufficient accommodation for the vessels trading on it. This will be completed, it is expected, in 1883. An old crib-work near Frenchtown will also be removed. These operations will exhaust the available balance of funds.

Money statement.

Amount appropriated by act passed August 2, 1882	$6,500 00
July 1, 1883, amount expended during fiscal year	944 42
July 1, 1883, amount available	5,555 58

Abstract of proposals for dredging and removing crib in Elk River, Maryland, opened ta 12.35 p. m., July 3, 1883.

No.	Names and addresses of bidders.	Date of commencement.	Date of completion.	Price for dredging.	Remarks.
				Per cu. yd.	
1	Geo. W. Parsons, Salisbury, Md..	Two months from award of contract.	In five working months.	$0 23½ *31	For depositing with a chute, in place.
2	Geo. E. Ward, Ridge P. O., Md..	Aug. 15, 1883	Dec. 15, 1883	27.4	

* Measured in scows—scowed away.

Contract with George W. Parsons.

COMMERCIAL STATISTICS OF ELKTON, MARYLAND.

[Furnished through the courtesy of Hon. E. H. Webster, collector of the port of Baltimore.]

There are now received here annually about 10,000 tons of coal, 3,000 cords of poplar wood, 600 tons of soda-ash, 300 tons bleaching powder, 3,000 tons fertilizer materials, 10,000 bushels of lime, besides large quanities of miscellaneous general merchandise and lumber. There are shipped from here 100,000 bushels of grain, 1,000 tons of fertilizers, besides baled hay, ship-timber, &c. The boats engaged in the trade are barges carrying from 130 to 300 tons, and about twenty schooners running in register from 36 to 85 tons. In 1875 there was actually no business done by the water at this point, as the river here was not navigable. The trade is certainly growing fast. Large pulp-works, 186 by 100 feet, are now being built, which will further increase its volume of trade, and a new wharf, 300 feet front, was finished this summer.

H 4.

IMPROVEMENT OF CHESTER RIVER FROM SPRY'S LANDING TO CRUMPTON, MARYLAND.

The first appropriation for this work was made March 3, 1881, $6,500. It was expended in 1881 and 1882 in dredging a channel 8 feet deep at mean low water, 70 feet wide, through the shoal above Spry's Landing and two bars above, making a total length of 3,850 feet of dredged channel.

The appropriation of $6,500, made August 2, 1882, has been applied to widening to 120 feet the channel previously dredged.

Money statement.

July 1, 1882, amount available		$166 84
Amount appropriated by act passed August 2, 1882		6,500 00
		6,666 84
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,231 32	
July 1, 1883, outstanding liabilities	322 21	
		3,553 53
July 1, 1883, amount available		3,113 31

Abstract of proposals for dredging Chester River, Maryland, opened at 1 o'clock p. m., September 15, 1882.

No.	Names and addresses of bidders.	Date of commencement.	Date of completion.	Measured in place.	Measured in scows.
1	James Caler & C. T. Caler, Baltimore, Md.	Oct. 10,1882	In 90 days ..	.....	$0 25½
2	D. Constantine, Baltimore, Md	Jan. 15, 1883	June 30, 1883	$0 27	22
3	George W. Parsons, Salisbury, Md.....	Feb. 1, 1883	June 1, 1883	31	28

Contract with D. Constantine.

COMMERCIAL STATISTICS.

BALTIMORE, *July* 31, 1883.

COLONEL: The following statistics of the trade of Crumpton were furnished by Mr. George E. Harrison, a prominent merchant of that place, and are believed to be reliable:

There are two steamers making daily trips between Crumpton and Baltimore, and one sailing vessel which makes one round-trip every week. These vessels carry annually from the town 100,000 bushels of grain, about 40,000 baskets of peaches, and considerable quantities of apples, pears, and berries. One thousand tons of phosphates, 600 tons of coal, and 500 bushels of clover-seed are brought to the town annually for the use of the farmers of the neighborhood. The town contains eleven stores, one large hotel, two churches, two public and one private school, one lumber, coal, and phosphate yard, and seven steam fruit evaporators.

Crumpton has a population of about 300, and is situated 5 miles below Kirby's Landing, which is at the head of navigation of the Chester River. The nearest railroad station to the town is "Lambson's," on the Kent County, Smyrna and Delaware Bay Railroad, which is distant 5 miles. The country surrounding the town, both in Kent and Queen Anne counties, is highly improved and productive.

Yours, very respectfully, &c.,

J. E. SUDLER.

Col. WILLIAM P. CRAIGHILL,
Corps of Engineers, U. S. A.

H 5.

IMPROVEMENT OF CORSICA CREEK, MARYLAND.

The first appropriation of $5,000 was made August 2, 1882. As it seemed very little could be done with proper economy towards the execution of the project of improvement with this sum, it was deemed best that the money be held in reserve until it be seen whether Congress would make a further appropriation. In the summer of 1883 the increase of trade on the creek called renewed attention to it. A request

was made for some dredging to facilitate the navigation. To determine what, if anything, could be best done with the funds available, required a resurvey of part of the stream. The results of this survey are not yet known. Should it seem expedient, a special report will be made later.

Money statement.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount expended during fiscal year	4 30
July 1, 1883, amount available	4,995 70
Amount (estimated) required for completion of existing project	25,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	25,000 00

H 6.

IMPROVEMENT OF CHESTER RIVER, AT KENT ISLAND NARROWS, MARYLAND.

Nothing has been done at this locality since September, 1877. There has been a balance of funds available, but it has not been found necessary to expend it.

Money statement.

July 1, 1882, amount available	$2,500 00
July 1, 1883, amount available	2,500 00

H 7.

IMPROVEMENT OF THE HARBOR OF QUEENSTOWN, MARYLAND.

Nothing has been done at this locality in the year ending June 30, 1883.

H 8.

IMPROVING CHANNEL TO BALTIMORE, MARYLAND.

At the end of June, 1882, the American Dredging Company of Philadelphia, under their contract for the removal of 2,250,000 cubic yards of materials from the cut-off between the Brewerton and the Craighill channels, had removed but 709,725 yards, and their rate of progress continued poor throughout 1882. It has greatly improved in 1883. Their work has been in deepening to 27 feet at mean low water.

An appropriation of $450,000 was made August 2, 1882. After due advertisement a contract was entered into, in September, 1882, with the Morris & Cumings Dredging Company of New York, for the excavation and removal of 2,500,000 cubic yards from the Fort McHenry Channel, the Brewerton and the Craighill channels, under which work was begun in October, 1882. The dredges were necessarily drawn off during a portion of the winter, but resumed work vigorously early in

the spring of 1883. A very large amount of dredging has been done up to June 30, 1883.

In order to procure other dredges, if necessary to hasten the attainment of a depth in the channel of 27 feet at mean low water, efforts were made to secure one or more of the large and powerful dredges so successfully used on the Saint Lawrence River near Montreal, and conditional arrangements were effected for doing so. This, however, did not become necessary.

In March, 1883, another contract was made with Mr. Thomas Potter, of Jersey City, N. J., for the removal of 500,000 cubic yards from the cut-off channel. These three contracts cover the available funds. It is expected under them to bring a channel to Baltimore, in 1883, 27 feet deep at mean low water, and not less at any point than 200 feet wide. This width is too little, and additional funds are needed for increasing it.

It has been found necessary to call attention, by means of the newspapers of the city and the extensive distribution of posters, to the violation of the law of the State of Maryland relative to dredging for oysters across and near the channels, to their manifest and serious injury. The authorities of the State have cordially co-operated in efforts to prevent violations of the law.

While preparing for the increased depth of 27 feet, it has been necessary to do some work at the angle of the Brewerton and Craighill channels in maintaining the depth of 24 feet at that point for present needs. This part of the Brewerton Channel, pushing out as it does into the currents of the Susquehanna opposite the mouth of the Patapsco, has always shown a tendency to shoal up. The opening of the cut-off, besides shortening the channel and giving a less abrupt connection between the Brewerton and Craighill channels, will also provide for the abandonment of this lower part of the Brewerton. The annual cost of maintenance of the whole channel will thus be also diminished materially.

It is greatly to be regretted that the additional funds needed for this great work were not provided at the last session of Congress, as arrangements could then have been made for continuing the work to completion in 1884. The work must, on the contrary, be suspended after 1883 unless funds be appropriated very early in the next session of Congress, say in December, 1883, or January, 1884. Should the appropriation be delayed to the middle of 1884, nearly the whole of 1884 would thus be lost for work, and the completion of the channel would necessarily run over into 1885.

Money statement.

July 1, 1882, amount available		$238,361 25
Amount appropriated by act passed August 2, 1882		450,000 00
		688,361 25
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$334,973 23	
July 1, 1883, outstanding liabilities	42,505 69	
		377,478 92
July 1, 1883, amount available		310,882 33
Amount (estimated) required for completion of existing project		450,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		450,000 00

Abstract of proposals for dredging in harbor at Baltimore, Md., opened at 12.05 *p. m., August* 31, 1882.

No.	Names and addresses of bidders.	Quantity bid for and location.	Date of commencement.	Date of completion.	Price.
					Per cu.yd.
1	George C. Fobes & Co., Baltimore, Md.	500,000 yards Fort McHenry Channel, or 500,000 yards Brewerton Channel, or 500,000 yards Craighill Channel.	Sept. 15, 1882..	Nov. 1, 1883	$0 18 14 17
2	Morris & Cumings Dredging Company, New York City.	2,500,000 yards, all, or 500,000 yards Brewerton Channel.	When contract is made.	June 30, 1883	16 13. 9
3	National Dredging Company, Wilmington, Del.	500,000 yards Brewerton Channel, or 500,000 yards Fort McHenry Channel, or 500,000 Craighill Channel.	When contract is made.	June 30, 1883	15 17 61
4	Atlantic Dredging Company, Brooklyn, N. Y.	750,000 yards Fort McHenry Channel.	Dec. 10, 1882...	Jan. 1, 1884	18½

* To be dumped not further than 1 mile south and west of Nine foot Knoll.

Contract with Morris & Cumings Dredging Company for all, at 16 cents per cubic yard.

Abstract of proposals for dredging in Patapsco River, Maryland, opened at 12.05 *p. m., March* 6, 1883.

No.	Names and addresses of bidders.	Date of commencement.	Date of completion.	Quantity bid for.	Price.
				Cubic yards.	*Per cu. yd.*
1	Thomas Potter, Jersey City, N. J.....	April 15, 1883	Dec. 31, 1883	500, 000	$0 13½
2	American Dredging Company, Philadelphia, Pa.	.....	Dec. 31, 1883	500, 000	28
3	Geo. C. Fobes & Co., Baltimore, Md.	June 1, 1883	Dec. 31, 1883	100, 000	32
4	Wright & Moore, Portland, Me.....	As soon as practicable.	Dec. 31 1883	500, 000	23

Contract with Thomas Potter, at 13½ cents.

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, BALTIMORE, MD.,
Collector's Office, August 4, 1883.

DEAR SIR: In accordance with your request of May 31, I take pleasure in furnishing you with the following statistics of the commerce of the port of Baltimore, and other places dependent upon it, for the fiscal year ending June 30, 1883.

* * * * * * *

COMPARATIVE SUMMARY OF GROSS IMPORTATIONS FOR THE YEARS 1882–'83.

1882:		
Free imports	$6, 858, 249 96	
Dutiable imports	8, 179, 098 00	
Total		$15, 037, 347 96
1883:		
Free imports	$5, 793, 542 89	
Dutiable imports	8, 866, 813 00	
Total		14, 660, 355 89
Decrease in 1883		376, 992 07

While the above exhibit shows a falling off in the gross value of imports for the year 1883, it is to be observed, however, that the decrease is limited to the line of free imports, and part cularly to the importations of coffee, the decrease in that commodity being $716,325; in nitrate of soda, $54,203; in crude brimstone, $50,946; in chemicals, &c., $68,498.

Yet, notwithstanding this decrease in a limited number of free imports, there has been an increase of $687,715 in dutiable i ports; although the value of the importations of sugar has fallen off $411,282, the following exhibit shows a gratifying increase in leading commodities:

Articles.	1882.	1883.	Increase.
Steel wire	$625, 653	$1, 226, 867	$601, 214
Cutlery	55, 369	60, 676	5, 307
Pig iron	789, 304	1, 070, 934	281, 630
Tin	1, 345, 342	1, 962, 065	616, 723
Soda ash	238, 714	453, 709	214, 995
Earthenware, &c	263, 204	413, 030	149, 826
Papier-mâche	23, 473	35, 055	11, 577

Merchandise on which the duties are paid is forwarded on arrival, in large quantities, to cities West and South.

Merchandise transported in bond, with appraisement.

Destination.	Invoice value.	Duties.
New York	$1, 116	$969 59
Milwaukee	8, 639	3, 455 60
Wheeling, W. Va	2, 318	975 10
Cincinnati	399	99 75
Philadelphia	45, 508	20, 227 70
Pittsburgh	27, 176	6, 249 70
Saint Louis	95, 222	42, 468 13
Total	180, 378	74, 445 57

Transportation in bond, without appraisement, under act June 5, 1880.

Destination.	Invoice value.	Duties.
Cleveland	$10, 128	$4, 900 00
Philadelphia	753	285 37
Saint Louis	149, 237	44, 235 18
Milwaukee	17, 209	7, 040 60
Chicago	118, 798	49, 457 22
Cincinnati	77, 502	24, 400 52
Georgetown, D. C	14, 619	6, 120 85
Pittsburgh	735, 230	226, 780 00
Indianapolis	46, 285	18, 323 45
Total	1, 169, 761	381, 543 19

DUTIES COLLECTED AND DUE ON MERCHANDISE IN BOND AND TRANSPORTED IN BOND'

Duties collected		$2, 957, 583 00
Duties due on merchandise in bond		170, 152 39
Duties due on merchandise transported in bond, with appraisement	$74, 445 57	
Duties on merchandise transported in bond, without appraisement	387, 543 19	
		3, 583, 724 15
Currency collected, fees, &c		189, 037 05
Grand total		3, 772, 761 20
Total collections 1883		3, 772, 761 20
Total collections 1882		3, 383, 734 91
Increase		389, 026 29

From all the sources named above from which revenue is derivable there has been an appreciable increase.

* * * * * * *

COMPARATIVE SUMMARY OF EXPORTS.

Exports 1883	$54,985,471
Exports 1882	38,534,426
Increase	16,451,045

This comparative summary of the value of exports for the years 1882 and 1883 affords a gratifying evidence of the increase in the business and commerce of the port.

Exports in which there has been a noted increase.

Articles.	1882.	1883.	Increase.
Cotton	$9,199,765	$13,467,703	$4,267,938
Rosin and turpentine	145,150	164,975	19,825
Lumber	264,098	413,536	149,438
Indian corn	3,365,946	5,850,053	2,484,107
Wheat flour	2,640,636	2,778,298	137,662
Wheat	15,866,163	23,530,631	7,664,468
Horned cattle	444,130	862,676	418,546
Sheep	9,333	30,562	22,229

Among the items of increase mentioned are those of cattle and sheep. This class of shipments from this port have been exceptionably successful, the percentage of loss amounting to an average of only about one and one-half per cent. on the total number shipped within the year.

VESSELS ENTERED FROM FOREIGN PORTS.		Tonnage.
American	214	70,126
Foreign (sail)	325	195,075
Foreign (steam)	370	631,188
Total	909	896,389

VESSELS CLEARED FOR FOREIGN PORTS.		
American (sail)	204	.....
American (steam)	5	65,609
Foreign (sail)	330	.....
Foreign (steam)	398	876,671
Total	937	942,280

		Tonnage.
Vessels entering coastwise	1,371	1,014,024
Vessels clearing coastwise	2,154	1,557,947
	3,525	2,571,971

TONNAGE TAX COLLECTED.	
1883	$95,352 90
1882	88,255 20
Increase	7,097 70

Emigrants arriving during the year 36,617

REGISTERED TONNAGE.		Tonnage.
Permanent registers (sail)	46	13,662 62
Temporary registers (sail)	23	10,629 68
Temporary registers (steam)	1	770 80
Permanent enrollments (sail)	598	26,967 94
Permanent enrollments (steam, wooden)	52	14,299 28
Permanent enrollments (steam, iron)	42	18,112 53
Permanent enrollments (barges)	4	1,177 46
Temporary enrollments (sail)	14	4,419 80
Temporary enrollments (steam)	1	189 12
Licenses under 20 tons:		
Sail, coasting trade	283	3,392 84
Steam, wooden, coasting trade	52	561 45
Steam, iron, coasting trade	3	45 11
Total	1,119	94,228 63

Enrolled vessels licensed for fisheries, 34 ..... 1,137 98
Vessels built, 6 ..... 258 70

The full tonnage of the coastwise trade does not appear in these statistics, as many vessels in the trade are not required to enter or clear.

This branch of the commerce of the port is one of importance. In it are engaged vessels of all classes, both steam and sail. The products and merchandise received and distributed by this medium of the coastwise trade are of great volume and value, comprising commodities both natural and manufactured of the cities and towns on the Atlantic seaboard and the Gulf of Mexico, and extends to the Pacific coast to San Francisco.

Coal is shipped in large quantities from this port to the last-named city in vessels of heavy tonnage. One shipment was recently made of 2,750 tons, and numbers of shipments of this character are made in the course of the year, requiring vessels of a tonnage varying from 1,800 to 3,000 tons.

The tonnage of the coastwise trade is of considerable volume, and is due in part to the number of steamships, either entering at this port in ballast from some place on the Atlantic seaboard for outward cargo, or clearing from this port in ballast for a similar destination for outward cargo.

PRINCIPAL LINES OF STEAMSHIPS.

"North German Lloyd," for Bremen; passengers and freight from Hamburg, London, Havre, Antwerp, &c.

"Allan Line," for Liverpool; passengers and freight from and to London, Hamburg, Rotterdam, Amsterdam, Havre, Antwerp, Bordeaux, Halifax, N. S., &c.

"Hooper's Line," for Liverpool.

"West India and Pacific Line," for Liverpool.

"Continental Line," for London, &c.

"Tully Line," for Rotterdam *via* Newcastle-on-Tyne.

"Donaldson Clyde Line," for Glasgow.

"Great Western Steamship Line," for Bristol.

"Johnston Line," for Liverpool and Barrow-in-Furness; cattle line and assorted freights, comprising a number of first-class steamships built expressly for cattle transportation.

"Carr's Line," for Hamburg, calling at Antwerp.

"Compagnie Générale Transatlantique," for Havre.

"Netherlands-American Steam Navigation Company," for Amsterdam and Rotterdam; passengers and freight.

These lines of foreign-going steamships have largely multiplied of recent years, and new ones are constantly being added.

SEA-GOING COASTWISE LINES.

"Merchants and Miners' Transportation Company," for Boston, Providence, Savannah, Charleston, and all points south.

"Baltimore, New Berne, and Washington, N. C., Steamship Line."

"New York and Baltimore Steamship Company"; freight and passengers, New York and Baltimore.

BAY AND RIVER LINES.

"Baltimore, Chesapeake, and Richmond Steamboat Company," for Richmond and points south.

"Powhatan Line," for Richmond.

"Baltimore Steam Packet Company" (old Bay Line); Portsmouth and Norfolk, Va., connecting with railroads for points south.

"Richmond and York River Line."

"Roanoke, Norfolk and Baltimore Steamboat Company."

"Weems' Line," for Patuxent and Rappahannock rivers.

"The Eastern Shore Steamboat Company," for various places on the eastern shore of Maryland and Virginia.

"Maryland Steamboat Company," for Easton, Oxford, Cambridge, &c.

"Chester River Steamboat Company."

"Susquehanna Steamboat Company," for Port Deposit and Havre de Grace.

"Potomac Transportation Line," for Alexandria, Va., and Washington, D. C.

"Steamboat Line," for Seaford, Del.

These bay and river lines touch at points in Maryland and Virginia, which are the sources of a valuable and extensive trade.

This trade enters largely into the domestic and foreign commerce of the country, and is of that general importance which deserves that the water-way to the places where it is carried on be kept open and of easy access.

WHARF FRONTAGE WITHIN ESTABLISHED LINES.

	Miles.
Built up, about	24
Shore line, about	6

The extension of its wharf frontage is one of the signs of business growth and commercial expansion of the port of Baltimore. The new water front of the Baltimore and Ohio Railroad Company at Curtis' Creek is being made available for commercial purposes, and will add a valuable wharf frontage to the harbor, and prove an important adjunct to the local trade of the city.

GENERAL ORDER STORES.

The well-known facilities afforded by these stores for the rapid discharge of the cargoes of steamships arriving at this port need only a passing notice. These stores are located at Locust Point, the terminus of the Baltimore and Ohio Railroad, and comprise inclosed and covered piers, and a substantial three-story brick warehouse. Two of these buildings are about 750 feet in length, to one of which an extension has recently been added, increasing its length to about 1,200 feet.

FACILITIES FOR IMPORTATION AND EXPORTATION OF CATTLE.

In addition to the facilities afforded at Locust Point for the rapid discnarge and lading of merchandise, the advantages offered there for the lading and unlading of cattle are equally excellent.

The stock is driven from the vessel through portable pens placed between the vessel and the cars, standing upon a track in the center of the building, and is shipped direct to the United States quarantine grounds, located at Patapsco Station, about 6 miles distant, on the main line of the Baltimore and Ohio Railroad.

The buildings about being completed there will afford accommodations for about 400 head of cattle, to which easy access is had from a siding laid from the main track of the road.

In the exportation of cattle, the system for the delivery of stock at the pier is equally expeditious, the cattle being brought in cars to the pier, and delivered directly upon the vessel. This must prove of great value to the cattle trade, as dispatch is indispensable to its success. At Canton, the terminus of the Northern Central Railroad, similar facilities for the discharge of cargoes of vessels are provided; wharves with covered piers and grain elevators. An extensive yard has been inclosed for the storage of iron in bond, and general order stores similar to those at Locust Point are about to be opened. In this connection it may be stated that the Government property at Fort McHenry adjoining the dry dock offers admirable natural advantages for the establishment of the general order stores. A very valuable frontage, now covered by water, could be reclaimed by filling up with waste ballast from vessels, and buildings could be erected there on piles, with ample docks on either side. This water waste at Fort McHenry, comprises one of the most valuable commercial sites in the harbor of Baltimore. With general order stores there under the direct control of the Government an important auxiliary to its business would be afforded, valuable facilities and enlarged accommodations would be furnished the commerce of the port, and a revenue result to the Government from property now unproductive.

Among the enterprises which have a bearing upon the commerce of the port is the laying of a petroleum-pipe line from the oil regions to Baltimore, now completed. The construction of this line has stimulated this class of enterprises, and an additional one is in contemplation.

This exhibit, therefore, fairly justifies the liberal appropriations heretofore made by Congress for the improvement of the harbor of the port, and it affords strong reasons for similar appropriations for the future; it clearly shows to what an extent the trade, business, and commerce of the city are interwoven with that of the country.

It is therefore a fair and reasonable conclusion, based upon the course and current of trade at this port, that the improvement of its harbor is not only a matter of local concern, but one which affects a large and rich area of the country which needs a central outlet to the sea.

Accompanying this communication is forwarded such information respecting certain places designated in your letter as could be obtained through the courtesy of gentlemen who have furnished the same, in compliance with a written request from this office.

Permit me to hope that this exhibit may prove of service to you in the preparation of your report to Congress relative to the improvement of rivers and harbors.

I am, very respectfully,

EDWIN H. WEBSTER,
Collector.

WM. P. CRAIGHILL,
Lieut. Col. of Engineers, U. S. A.

H 9.

IMPROVEMENT OF THE HARBOR AT ANNAPOLIS, MARYLAND.

There are two bars with not more than 18½ feet on them at mean low water, which prevent very large ships from passing into the deeper water (24 feet and more) of the Severn River, just abreast of the Naval Academy. The commerce of Annapolis is small; its importance arises mainly from its being the seat of the Naval Academy, and from its strategic relations to the capital of the nation.

The project adopted for the improvement of the harbor and the entrance to it has been the excavation, by dredging, of a channel 24 feet deep at mean low water, with a minimum width of 150 feet. The rise of the tide is only about 1 foot. The cost of this improvement has been estimated to be $66,000.

Two appropriations have been made: one of $5,000, June 14, 1880; the other, also of $5,000, March 3, 1881. As the expenditure of $10,000 would not effect any substantial improvement, it has been decided to await further action of Congress in this case.

If any additional appropriation be made, it should be for the balance required to complete the estimate for the channel 150 feet wide, 24 feet deep, $56,000.

Money statement.

July 1, 1882, amount available	$9,205 98
July 1, 1883, amount available	9,205 98
Amount (estimated) required for completion of existing project	56,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	56,000 00

COMMERCIAL STATISTICS OF ANNAPOLIS, MARYLAND.

[Furnished through the courtesy of Hon. E. H. Webster, collector of the port of Baltimore.]

Up to this time none of the river and harbor appropriations have been expended in the improvement of our harbor except in the way of surveys upon which to base an estimate of the probable cost of the contemplated work of deepening the mouth of the harbor between Horn Point and Greenberry Point, so that it will be quite impossible for me to say or give you information from which any inference can be drawn, what benefits have been conferred upon the commerce of this port by the appropriation already made for river and harbor improvement. The average receipts of coal are 8,000 tons, and freighted in vessels of 200 to 300 tons capacity, 4,060 tons of ice, 3,000,000 feet of lumber, besides brick and other building materials. The tonnage of the vessels for the above uses has to be according to the present depth of water. With greater depth the commercial interests of the port would be materially enhanced.

H 10.

IMPROVEMENT OF THE CHOPTANK RIVER BETWEEN DENTON AND GREENSBOROUGH, MARYLAND.

There have been three appropriations for this work, viz, $5,000 June 14, 1880; $5,000 March 3, 1881, and $5,000 August 2, 1882. With the first, a channel 75 feet wide and 6 feet deep at mean low water was made available to a point 4,000 feet above the Brick Mills. By means of the second, a channel of the same depth, but of a width of 60 feet, was carried to a point 6,250 feet above the mills. With the third, work

was resumed in February, 1883, and concluded early in May, 1883, with the exhaustion of the appropriation.

From the point where the work was suspended in 1881, a channel 22 feet wide and 6 feet deep was dredged for a length of 150 feet until a natural depth of 6 feet was found. The dredging was resumed 1,150 feet higher, and continued 300 feet, when a natural depth of 6 feet for 1,600 feet was again found. The dredged channel was again carried up 4,020 feet, to a point where the river becomes narrow, and from which 3 to 4 feet of water can be found to the shoal immediately below Case's, a distance of 2,300 feet.

No dredging was done in this narrow part of the river where the depth of water was 3 feet or more (that depth being sufficient for the lighter navigation), as it was thought best to expend the money available in getting a channel through the shoal below Case's. In furtherance of this idea the dredge was put in at the lower end of this shoal, and a channel 22 feet wide and 5 feet deep at mean low water was cut a linear distance of 1,250 feet through the shoal to the 3-foot curve opposite Case's. The lighters carrying grain, &c., can now navigate the channel at any stage of the tide, from Case's to "The Stakes," a great improvement.

Money statement.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4,949 67
July 1, 1883, amount available	50 33
Amount (estimated) required for completion of existing project	25,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	10,000 00

Abstract of proposals for dredging Choptank River, Maryland, opened at 12.30 *o'clock p. m., September* 15, 1882.

No.	Names and addresses of bidders.	Date of commencement.	Date of completion.	Measured in place.	Remarks.
1	Geo. W. Parsons, Salisbury, Md.	Dec. 1, 1882	May 1, 1883	*Per cu. yd.* $0 28	Where there may be 2 feet of water at low tide; measured in scows 25 cents per cubic yard.
2	D. Constantine, Baltimore, Md.	Jan. 15, 1883	June 30, 1883	27½	

Contract with D. Constantine.

COMMERCIAL STATISTICS.

BALTIMORE, *July* 31, 1883.

COLONEL: The town of Greensborough, which will be chiefly benefited by the improvement of the upper Choptank, is situated on the headwaters of that river, and has a population of about 800 persons. The surrounding country within a radius of 5 or 6 miles is thickly settled and productive, and draws its supplies from and brings its products to this place, There are two large canning establishments in the town which handle annually 100,000 baskets of peaches and large quantities of corn, tomatoes, &c. There is also one very extensive steam saw-mill and lumber manufactory which

produces from 500,000 to 1,000,000 feet of lumber annually, and five smaller mills in the vicinity, the products of which are brought to this town. There is a ship-yard here where vessels of several hundred tons are built. There are ten stores in the town doing a large business in general merchandise; several blacksmith and wheelwright shops, and seven large steam fruit evaporators in constant operation during the season. From 80,000 to 100,000 bushels of wheat; 125,000 bushels of corn, besides considerable quantities of rye and oats are shipped from here annually, and from 100,000 to 125,000 bushels of lime and shells. From 600 to 700 tons of fertilizers and 200 to 300 tons of coal, and large quantities of building materials are received.

The following is an extract from a communication on the subject of the trade of the town, signed by Messrs. Satterfield, Moore, Massey, Manlove, and eleven others, prominent citizens and business men of the town:

"The most of our trade is with Baltimore and would be greater but for the want of sufficient depth of water so that boats could come to our town. As it is, we have, at great expense and detention, to lighter our produce and all goods down the river to the boats in open flat scows; and lighters are too slow in this day for our farmers, mechanics, and merchants. If we could have an appropriation from the General Government to finish the work of deepening the channel, already more than half done, so that steam propellers could come to our wharves, we think the trade of our town would be more than doubled in a few years. As we are now situated, a great portion of our trade is driven from its natural channel and destination, Baltimore, to Philadelphia, which we can reach sooner by rail although at greatly increased expense."

There is a manufactory of fertilizers in the town recently started, but doing a very good business.

Very respectfully, &c.,

J. E. SUDLER.

Col. WM. P. CRAIGHILL,
Corps of Engineers, U. S. A.

H 11.

IMPROVEMENT OF SECRETARY CREEK, MARYLAND.

Operations were closed in May, 1881, according to the plan fully explained in the Annual Report for 1881.

There was nothing done in the year ending June 30, 1883.

H 12.

IMPROVEMENT OF THE HARBOR OF CAMBRIDGE, MARYLAND.

The plan of improvement was to make a channel from the deep water of the Choptank to the railroad wharf in the inner harbor, and to increase the dimensions of that harbor, the outer channel to be not less than 100 feet wide, and the depth of the dredging to be 8 feet at mean low water.

This plan has been successfully carried out to the great benefit of the trade of the town. The last work done was in March, 1879. There is a balance of funds still available, and some urgency has been exhibited to cause its expenditure, but the necessity therefor for the general good has not been seen, and the money has not been spent.

Money statement.

July 1, 1882, amount available	$2,687 70
July 1, 1883, amount available	2,687 70

H 13.

IMPROVEMENT OF TREADHAVEN CREEK, MARYLAND.

The last appropriation was made March 3, 1881, and was at once expended according to the plan detailed in the Annual Report for the year ending June 30, 1881.

Nothing has been done in the year ending June 30, 1883.

H 14.

WATER PASSAGE BETWEEN DEAL'S ISLAND AND LITTLE DEAL'S ISLAND, MARYLAND (LOWER THOROUGHFARE).

Full report of the improvement at this place was made in the Annual Report for the year ending June 30, 1882. Nothing has been done in the year ending June 30, 1883.

Money statement.

July 1, 1882, amount available	$78 92 00
July 1, 1883, amount expended during fiscal year	76 67 00
July 1, 1883, amount available	2 25 00

COMMERCIAL STATISTICS OF DEAL'S ISLAND.

[Furnished through the courtesy of Hon. E. H. Webster, collector of the port of Baltimore.]

Business, oysters and fish, general merchandising, trucking, and farming. There are three hundred vessels engaged in the oyster business, employing 1,500 men, and catching 400,000 bushels of oysters, valued at $150,000; 5,000 bushels of corn, $3,750; 1,500 bushels of sweet potatoes, $1,500; 1,000 bushels of white potatoes, $1,000; twenty-one stores, selling goods valued at $100,000. The above products are conveyed by sailing vessels exclusively. The trucking business is growing, and the products are conveyed by river steamers—value not known.

H 15.

IMPROVEMENT OF UPPER THOROUGHFARE BETWEEN DEAL'S ISLAND AND THE MAINLAND ON DAME'S QUARTER, MARYLAND.

A special report was submitted September 16, 1882, which is appended below. Nothing has been done at this locality in the year ending June 30, 1883.

UNITED STATES ENGINEER OFFICE,
Baltimore, September 16, 1882.

GENERAL: In the monthly report of operations, September 1, 1882, for the Upper Thoroughfare between Deal's Island and the mainland on Dame's Quarter, it was stated that when the map of the recent survey was completed a special report would be made. The map is complete and a tracing is herewith. The tracing also shows the outlines of the land and water in the vicinity traced from the Coast Survey maps.

Colonel Craighill in his letter of August 15, 1882, referred to the possibility of a new project. The project referred to therein was to make an anchorage basin not far below the pile bridge, with an approach dredged to the deep water at the mouth of

the bay and necessary protection works. The work for this would cost several times the amount of the present appropriation, and if the prosecution of this project be the question at issue I would recommend that nothing be done until more funds be available, for the expenditure of the amount now in hand ($5,000), would serve no good purpose.

Since a former report by Colonel Craighill (of January 9, 1882, referred to in his letter of August 15, 1882) the Maryland Steamboat Company have built the wharf shown on the tracing. It is understood that this company intend eventually to fill in between the piling of this structure with oyster shells. A basin immediately inside this pier would be located about as proposed in Colonel Craighill's report of January 9, 1882, and which, with the protection breakwater, was estimated to cost about $15,000. If the Maryland Steamboat Company's pier was filled in solid, thus forming the protecting dike or breakwater, the dredging alone would cost about $6,000.

If the dredging be now done, it is believed the basin would suffer rapid deterioration from filling by sand in storms. But the funds on hand are too little to permit dredging and protection also. To illustrate this, two basins are outlined to the leeward of the pier. That outlined by the full red line is estimated to cost as follows:

Dredging, at 25 cents per cubic yard	$3,160
Protection formed by stone along the line of the pier, that structure being used for convenience of deposit (stone $1.75 per cubic yard, in place)	8,030
Total	11,190

The basin outlined by the broken red line is estimated to cost as follows:

Dredging	$5,000
Protection breakwater	10,000
Total	15,000

An alternate to dredging a basin to the leeward of the pier is a breakwater to the windward thereof, leaving the filling on the pier line to be done by the steamboat company in their own time. Such a breakwater, with a width of 10 feet on top, at a level about 1 foot above high water, with a seaward slope of 1 on 2, and an interior slope of 2 on 3, will cost about $25 per linear foot, stone being reckoned at $1.75 per cubic yard, in place. The funds now available would then build a mole of less than 200 feet in length, and the protection afforded by that length would be of little service.

I have, then, to report that I can see no useful purpose to which the present appropriation can be advantageously applied, and that I recommend that nothing be done until further funds be available, or until the return of Colonel Craighill, to whom I will refer the matter when he again takes charge.

Very respectfully, your obedient servant,

THOMAS TURTLE,
Captain of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

Money statement.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount expended during fiscal year	189 74
July 1, 1883, amount available	4,810 26
Amount (estimated) required for completion of existing project	15,000 00

H 16.

IMPROVEMENT OF BROAD CREEK, FROM ITS MOUTH TO LAUREL, DELAWARE.

At the end of June, 1882, work was in progress in dredging, under contract, a channel 6 feet deep at mean low water from the railroad bridge below the town of Laurel to a point about 7,000 feet below. The

width of channel was restricted to 32 feet, as this was as much as could be given with the available funds, $15,000. The rise of tide is 3 feet, which gives that much increase of depth at high water.

The channel was also straightened and widened for an additional distance down of 4,300 feet by cutting off some sharp points. The work was brought to a close in February, 1883.

A survey was made in March, 1883, which showed considerable filling of the dredged channel. It is no longer possible to carry 6 feet at low water to the bridge, and the 5-foot channel is narrowed in several places to 25 feet.

The original report and estimate referred to the necessity of building regulating works to retain the depth obtained by the dredge. Money to build them was not provided. It does not seem expedient to dredge more unless dikes be built.

The appended estimate is for the building of dikes and the restoration, by dredging, of the 6-foot depth in a channel about 50 feet wide, which is as great a width as the stream will bear.

To excavate 50,500 cubic yards, following line of present channel	$12,625
10,000 linear feet of diking	12,500
Contingencies	2,500
Total	27,625

Or, if we rectify the direction of the channel by correcting some too sharp bends, especially below Big Mills:

To excavate 68,500 cubic yards	$17,125
Diking	12,500
Contingencies	3,000
Total	32,625

Money statement.

July 1, 1882, amount available	$6,170	17
Amount appropriated by act passed August 2, 1882	5,000	00
	11,170	17
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	11,170	17
Amount (estimated) required for completion of existing project	32,625	00
Amount that can be profitably expended in fiscal year ending June 30, 1885	20,000	00

Abstract of proposals for dredging Broad Creek, Delaware, opened at 11.30 *o'clock a. m., September* 15, 1882.

No.	Names and addresses of bidders.	Date of commencement.	Date of completion.	Measured in scows.	Measured in place.	Remarks.
				Per cu. yd.	*Per cu. yd.*	
					$0 32	Material that requires blasting.
1	George W. Parsons, Salisbury, Md.	In ten days	Mar. 1, 1883	$0 22	25	Material that does not require blasting.
					18	For material cast over.
2	D. Constantine, Baltimore, Md.	.....	June 30, 1883	.....	30	

Contract with George W. Parsons.

H 17.

IMPROVEMENT OF THE WICOMICO RIVER, BELOW SALISBURY, MARYLAND.

Nothing was done on this river in the year ending June 30, 1883, except to make the examination called for in the act of August 2, 1882. No appropriation was made for the Wicomico in 1882. A balance remains of the appropriation of 1881. The river continued in quite good condition until in June, 1883, it was found a little dredging was necessary. Proposals were called for, and a contract has been made to the extent of the available funds.

Money statement.

July 1, 1882, amount available	$1,508 41
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	123 03
July 1, 1883, amount available	1,385 38

Abstract of proposals for dredging in the Wicomico River, Maryland, opened at 12.05 p. m., July 3, 1883.

No.	Name and address of bidder.	Date of commencement.	Date of completion.	Price.	Remarks.
1	Geo. W. Parsons, Salisbury, Md.	Three weeks from award of contract.	Six working weeks.	*Per cu. yd.* $0 22 / 30	Deposited with chute. Scowed away; measured in scows.

Contract with George W. Parsons.

COMMERCIAL STATISTICS OF WICOMICO RIVER FROM SALISBURY DOWN.

[Furnished through the courtesy of Hon. E. H. Webster, collector of the port of Baltimore.]

The character of the trade and business is lumber, general merchandising, agriculture, packing oysters and fruit, fishing, manufacture of fertilizers, iron foundry, and planting oysters. There are twenty-two mills engaged in the manufacture of lumber, producing 15,000,000 feet of undressed lumber; 5,000,000 feet dressed lumber; 1,000,000 peach crates; 1,000,000 packing cases; 10,000 berry crates; 4,000 cords of kindling wood, valued at $650,000; one tin factory; one fruit factory (capacity, $30,000); two oyster-packing establisments; one fertilizer factory; one iron foundry; over 100,000 bushels of grain; 150,000 bushels of corn; 7,000 barrels of flour; 13,000 pounds wool; 600,000 quarts berries; 150,000 melons; 7,000 pounds vegetables; 10,000 crates peaches; 150,000 bushels of oysters; poultry, eggs, and live stock; shad, herring, and other fish, the value of which cannot be given. Two thousand tons coal and 500 tons fertilizers are also transported on the river, and over seventy stores report sales of merchandise aggregating $1,250,000. Twenty-five schooners (1,700 tons) and several hundred sloops and smaller craft are owned and navigate the river. There is one line of steamers to Baltimore and three marine railways on the river.

H 18.

REMOVAL OF OBSTRUCTIONS IN THE POCOMOKE RIVER, MARYLAND.

Operations were brought to a close in April, 1880, according to the plan detailed in full in the Annual Reports for 1879 and 1880. There was nothing done on this river in the year ending June 30, 1883, except to make an examination of it in compliance with the requirements of the law of August 2, 1882.

COMMERCIAL STATISTICS OF POCOMOKE RIVER FROM SNOW HILL DOWN.

[Furnished through the courtesy of Hon. E. H. Webster, collector of the port of Baltimore.]

Business and trade consist of general merchandising, shipbuilding, fruit and oyster packing, saw and flour milling, and agricultural productions. There are on or using the river twelve lumber mills, manufacturing 8,000,000 feet of lumber, valued at $125,000; four flour mills; four ship-yards and marine railways, building twenty vessels, average value of $2,000 each; two fruit and oyster packing establishments. There are two hundred vessels of all classes engaged in trade and oyster fishery, and carrying large quantities of grain and other agricultural products and general merchandise to the towns on the river to the value of $1,500,000 (estimated).

H 19.

IMPROVEMENT OF ONANCOCK HARBOR, VIRGINIA.

Operations at this place were closed in April, 1881, according to the plan fully explained in the Annual Report for year ending June 30, 1881. Nothing was done in the year ending June 30, 1883.

COMMERCIAL STATISTICS OF ONANCOCK, VIRGINIA.

[Furnished through the courtesy of Hon. E. H. Webster, collector of the port of Baltimore.]

For the year ended June 30, 1883, the following articles of produce were shipped from Onancock: 120,000 barrels, valued at $195,000; peaches, oysters, small fruits, eggs, &c., $48,000; lumber and barrels, $18,500; aggregate, $261,500. The imports, consisting of general merchandise, aggregated $230,000. In the trade of the port three side-wheel steamers, 1,746.03 tons, and fifteen sail vessels of 456.54 tons, were engaged.

H 20.

IMPROVEMENT OF THE JAMES RIVER, BELOW RICHMOND, VIRGINIA.

Very little work has been done during the year ending June 30, 1883. For this there has been a double reason. The condition of the river, though not entirely satisfactory, has been quite permanent and has seemed to suffice for the absolute requirements of navigation. In the state of uncertainty whether Congress intends to authorize a change of project from a depth of 15 to 22 feet at low water, it has not seemed judicious to do much work on the smaller project, as some of it would be not only useless, but injurious in the larger. It is hoped the opinion of

Congress may be plainly set forth in the next appropriation for this river.

The figures in the money statement below refer to the smaller project. Should Congress approve the larger, the appropriation should be at least twice as large to insure good results.

The report of Captain Turtle is appended.

Money statement.

July 1, 1882, amount available	$4,361 82
Amount appropriated by act passed August 2, 1882	75,000 00
	79,361 82
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	7,252 54
July 1, 1883, amount available	72,109 28
Amount (estimated) required for completion of existing project	525,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	150,000 00

Abstract of proposals for work in James River, Virginia, opened at 12.05 p. m., October 10, 1882.

No.	Name and address of bidder.	Logs.	Rock.	Excavation.	Mattress.
		Per lin. ft.	*Per cu. yd.*	*Per cu. yard.*	*Per sq. ft.*
1	Simon West, Petersburg, Va	$0 75	$0 70	$0 45	$0 23½

Evidently not the signature of the bidder. Bid not in duplicate. No bidder's bond accompanying proposal. The envelope was not marked as a proposal, and was opened with the ordinary mail at 9 o'clock a. m., October 10, 1882.

Bid rejected.

Abstract of proposals for hire of a dredge for the James River, opened at 12.05 p. m., April 20, 1883.

No.	Names and addresses of bidders.	Price per hour.	Remarks.
1	William W. Wright, Geneva, N. Y	$12 00	Double cylinder, 14 by 20 inches.
2	Daniel Constantine, Baltimore, Md	8 25	Double cylinder, 10 by 15 inches.

All rejected; price too high.

REPORT OF CAPTAIN THOMAS TURTLE, CORPS OF ENGINEERS.

BALTIMORE, *June* 30, 1883.

COLONEL: I submit the following report of progress in the improvement of the James River, Virginia, for the fiscal year ending June 30, 1883.

To Mr. Burgwyn, the local assistant engineer, I am indebted for most of the material of this report, and I have also to acknowledge the energetic performance of all duties required of him.

At the close of the last fiscal year active operations had been suspended because of the small balance unexpended of the appropriation. By the river and harbor act of August 2, 1882, the sum of $75,000 was appropriated for continuing improvement, the project then in progress being to obtain a depth of 18 feet at low tide, with a channel width of 200 feet from the sea to Warwick Bar, and a depth of 18 feet at high tide, with a channel width of 180 feet from that point to the ship-locks at Richmond, the excavation in rock which is only encountered for this depth in the latter portion, to be carried to 15 feet at low tide, equal to about 18½ feet at high tide.

On September 5, 1882, advertisement was made inviting proposals for dredging, rock excavation, and dike-work to be opened October 10, 1882. The dredging and

rock excavation was to be in the channel near Richmond, and the dike was to be at Randolph Flats. Only one proposal was received and it was deemed judicious to reject it.

It was afterward attempted to organize for the prosecution of this work by hired labor, the dredge to be contracted for after advertisement. Accordingly advertisement dated March 29, 1883, invited proposals for a dredge, to be opened April 10, 1883. Two bids were received, but the terms did not suit, and they were rejected. There has then been no progress in the completion of the improvement during the fiscal year. Nevertheless, Mr. Burgwyn reports that, although no instrumental survey was made, several examinations show the very gratifying fact that the condition of the river has remained sensibly the same, and that a small sum would suffice to repair the injury received by the dikes and jetties from the winter's ice and freshets.

According to a statement kindly furnished to Mr. Burgwyn by Capt. Thomas Cunningham, superintendent of dredging for the city, since the suspension of work by the United States, there have been removed from the harbor by the city machinery 43,290 cubic yards of sand, cobble-stones and decomposed rock; 197 bowlders, 30 logs, and 227 cubic yards of broken rock, besides 1,050 cubic yards of sand from Randolph Flats. The dredging in the harbor was from the "ship-locks slip" down to the *Ariel's* wharf, the material being dumped between the jetties, the large bowlders on and near the ends of them.

It is now the intention to still further widen the Dutch Gap Cut-off, the work to be done by contract after due advertisement, and to that end a survey has recently been made at Dutch Gap. It is found that the Gap is slowly deepening and that there is a gradual disintegration of the steep sides above the water surface, with a general increase of width.

Mr. Burgwyn has prepared a table from the records of the United States Coast and Geodetic Survey showing the rates of propagation of the flood tide in different sections of the river, which is here given for future use.

Section of river.	Distance.	Time.	Rate of propagation.
	Feet.	*Seconds.*	*Feet per sec.*
Old Point to Newport News	44,200	1,380	32.0
Newport News to Grove Wharf	115,900	5,940	19.5
Grove Wharf to Jamestown	43,400	1,920	22.6
Jamestown to Dillard's Wharf	29,800	2,040	14.6
Dillard's Wharf to Claremont	30,000	3,240	9.3
Claremont to Weyanoke	60,300	4,140	14.5
Weyanoke to Jordan's Point	48,000	1,320	36.4
Jordan's Point to City Point	16,000	1,020	15.7
City Point to Curle's Neck	59,200	4,800	12.4
Curle's Neck to Richmond Bar	95,000	2,460	38.7
Richmond Bar to Richmond	12,500	1,140	10.9

From the table it appears that the rate of propagation of the flood tide from Old Point Comfort to Richmond averages 18.8 feet per second, or about 13 miles per hour. Hence a steamer that can travel at this speed in coming up the river, if she starts at high tide, will find high tide everywhere as she goes along. The average velocity of the water at the swiftest period of the flood tide is about 2 feet per second, say one-ninth that of the flood-tide wave.

There have been three periods at which the water was considerably above the average, as follows:

January 21, 1883, 9.7 feet above low water.
April 18, 1883, 9.7 feet above low water.
April 26, 1883, 8.8 feet above low water.

These heights were exceeded every year in the eight preceding years, as may be seen by referring to the annual report for last year.

A partial investigation for estimating the volume of water passing through the various sections of the river during an average tide has been made. The river was divided into sections approximately at right angles to the channel line at regular distances apart measured on that line; the areas bounded by these section lines and the low-water and high-water lines were then measured by the planimeter. On the portion of the river between Richmond and Wilton, the map of the United States Engineers was used; from Wilton to Newport News the plane-table sheets of the United States Coast and Geodetic Survey were used. As the location of the high-water lines and the time of high water were accurately known from Mayo's Bridge to Wilton, a careful estimate of the volumes for this section of the river was made. This estimate here follows in tabular form.

MAYO'S BRIDGE TO WILTON.

[Areas included between lines 1,000 feet apart on channel line, and approximately at right angles to curve of river, taken from the map of 1880. Scale 1:2400.]

Sections.	Area in square feet.			Volume in cubic feet.		Remarks.
	Low tide.	High tide.	Mean area.	=Mean area ×3.5.	Sum of volumes.	
1	1,383,000	1,794,000	1,588,500	5,559,750	5,559,750	Mayo's Bridge.
2	1,345,200	1,836,600	1,590,900	5,568,150	11,127,900	
3	892,800	1,162,800	1,027,800	3,597,300	14,725,200	
4	836,400	858,600	847,500	2,966,250	17,691,450	Ship-locks.
5	540,000	544,800	542,400	1,898,400	19,589,850	Richmond and Danville Railroad Company wharves.
6	550,800	577,800	564,300	1,975,050	21,564,900	Old Sugar Refinery.
7	576,600	593,400	585,000	2,047,500	23,612,400	Rocketts.
8	666,000	716,400	691,200	2,419,200	26,031,600	
9	747,000	750,000	748,500	2,619,750	28,651,350	Brickyard Wharf.
10	760,800	771,600	766,200	2,681,700	31,333,050	Chesapeake and Ohio Railroad Company wharves.
11	687,000	725,400	706,200	2,471,700	33,804,750	
12	594,600	764,400	679,500	2,378,250	36,183,000	Almond Creek.
13	619,800	745,200	682,500	2,388,750	38,571,750	Stearn's Dike.
14	656,400	802,000	729,200	2,552,200	41,123,950	
15	716,800	812,000	764,400	2,675,400	43,799,350	Quarry Wharf.
16	815,600	895,600	855,600	2,994,600	46,793,950	Goode's Rock.
17	811,200	880,800	846,000	2,961,000	49,754,950	Upper end Richmond Bar.
18	821,200	890,000	855,600	2,994,600	52,749,550	Crest Richmond Bar.
19	879,600	1,052,800	966,200	3,381,700	56,131,250	Lower end Richmond Bar.
20	912,000	1,131,200	1,021,600	3,575,600	59,706,850	
21	1,024,800	1,191,200	1,108,000	3,878,000	63,584,850	Upper end Randolph Flats.
22	886,000	990,000	938,000	3,283,000	66,867,850	Crest Randolph Flats.
23	770,800	852,000	811,400	2,839,900	69,707,750	Lower end Randolph Flats.
24	854,800	1,028,400	941,600	3,295,600	73,003,350	
25	892,000	1,032,000	962,000	3,367,000	76,370,350	
26	874,000	966,000	920,000	3,220,000	79,590,350	
27	863,600	932,000	897,800	3,142,300	82,732,650	Warwick Wharf.
28	844,000	934,800	889,400	3,112,900	85,845,550	
29	804,800	959,600	882,200	3,087,700	88,933,250	Gunn's Wharf.
30	834,800	984,000	909,400	3,182,900	92,116,150	Upper end Warwick Bar.
31	872,800	1,004,800	938,800	3,285,800	95,401,950	Lower end Warwick Bar.
32	721,200	786,000	753,600	2,637,600	98,039,550	
33	680,400	760,800	720,600	2,522,100	100,561,650	
34	638,400	683,600	661,000	2,313,500	102,875,150	
35	663,200	712,800	688,000	2,408,000	105,283,150	
36	689,200	734,000	711,600	2,490,600	107,773,750	
37	.....	.....	.....	.....	.....	Wilton.
	28,727,600	32,857,400	30,792,500	107,773,750	.....	

The areas of the low-water and high-water basins below Wilton, though estimated, are not now presented, as the estimates of volumes cannot be made until simultaneous gauge-readings of an average tide throughout that portion of the river be available. This interesting question is left for the future.

There were left over from last year's survey for the project of 25 feet depth of channel a large quantity of notes, cross-sections, &c., upon which considerable work has been expended to place them in permanent shape for future reference and use.

Mr. B. C. Cook, the collector of the port, has kindly, at Mr. Burgwyn's request, furnished the following statement of the commerce of Richmond, from June 1, 1882, to May 31, 1883.

VESSELS ENGAGED IN THE FOREIGN TRADE.

	Vessels.	Tonnage.
Entered	38	11,828
Cleared	65	21,681

VESSELS ENGAGED IN THE COASTWISE TRADE.

	Vessels.	Tonnage.
Entered	419	434,590
Cleared	496	483,352

Value of imports	$435,567
Value of exports	1,075,242

Mr. Cook further states that there are probably 800 to 1,000 vessels in the coastwise trade, which arrive and depart, not included in the statement because their cargoes do not require them to clear from his office.

Tabulated statement of commerce, 1878 to 1883.

Trade.	1878.	1879.	1880.	1881.	1882.	1883.
Foreign trade:						
Vessels entered	38	48	44	36	27	38
Vessels cleared	96	132	129	118	90	65
Tonnage entered	9,427	15,499	15,175	13,286	10,070	11,828
Tonnage cleared	29,729	42,761	44,627	38,961	40,894	21,681
Coastwise trade:						
Vessels entered	558	446	586	946	1,220	419
Vessels cleared	531	505	546	604	639	496
Tonnage entered	464,670	413,057	474,801	784,516	1,000,820	434,590
Tonnage cleared	481,819	468,429	513,576	540,663	588,685	483,352
Value of imports	$201,253 00	$185,838	$132,844	$103,961	$123,383	$435,567
Value of exports	2,500,715 00	3,068,520	2,274,623	2,127,316	1,848,110	1,075,242
Receipts from customs	15,067 85	.....	.....	.....	.....	.....

The estimate for the amount required to complete the present project remains the same as reported in the last Annual Report, viz, $525,000.

If it be the intention of Congress to complete this project, the sum of $150,000 should be appropriated, while an appropriation of $300,000 would be judicious if it be intended to prosecute the enlarged scheme of greater depth.

Very respectfully,

THOMAS TURTLE,
Captain of Engineers.

Lieut. Col. WILLIAM P. CRAIGHILL,
Corps of Engineers, U. S. A.

H 21.

IMPROVEMENT OF APPOMATTOX RIVER, VIRGINIA.

The report is appended of the officers who have given special oversight to the work during the year ending June 30, 1883. The most gratifying matter to which attention may be particularly called is that the condition of permanence of deepened and improved channel seems to be nearly reached under the influence of the regulating works, which for a number of years have been introduced from time to time, as funds were provided by Congress. That this statement is true is confirmed by the non-use of the dredge in the year, and its use has been diminishing gradually year by year. The best results cannot be said to be reached until the dredge can be dispensed with under ordinary circumstances.

Money statement.

July 1, 1882, amount available		$852 41
Amount appropriated by act passed August 2, 1882		35,000 00
		35,852 41
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		13,373 00
July 1, 1883, amount available		22,479 41
Amount (estimated) required for completion of existing project		70,810 59
Amount that can be profitably expended in fiscal year ending June 30, 1885		70,810 59

REPORTS OF CAPTAIN THOMAS TURTLE, CORPS OF ENGINEERS.

1.

BALTIMORE, MD., *June* 30, 1883.

COLONEL: The following report on the progress of the improvement of the Appomattox River, Virginia, is respectfully submitted for the fiscal year ending June 30, 1883.

The tug-boat which was nearly ready at the close of the previous fiscal year was completed and sent to Petersburg.

Lieut. C. McD. Townsend, Corps of Engineers, reported at Petersburg early in August, 1882, and the execution of the work has since that date been under his personal supervision. His report of operations is as follows:

"The operations during the year have consisted in building the works of contraction of the project of July 1, 1882, in the harbor of Petersburg and along the southern bank of the river at Magazine Bend; in strengthening the works at the entrance of Puddledock Cut, was to enable them to withstand the action of freshets, and in repairing damages caused by preceding freshets.

"To maintain the channel dredged in the harbor of Petersburg in 1881, there have been built ten new timber jetties. At Magazine Bend three timber and seven wattled jetties have been constructed. At the entrance to Puddledock Cut 310 feet of the closure dike and 40 feet of Jetty 22, which were washed away by the freshets of 1881, have been rebuilt, and 430 feet of the old deflector in rear of the dike repaired. To check a tendency to scour in rear of the dike, a layer of gravel from 3 to 6 feet thick was deposited between the sheet piling and the bracing piles, from Jetty 21 to Jetty 22. On the side toward the river, that portion of the closure dike between Jetty 22 and the abutment had previously been protected from scour by a layer of mats. This layer was continued along the rest of wall (450 feet). These mats were of brush and were 20 feet long, by 10 wide, by 2½ thick; they were placed with their ends to the wall and covered with enough gravel to hold them firmly in position. On these a second layer was sunk, the mats being placed end to end. This layer extends along the wall from Jetty 21 to Jetty 24 (1,200 feet).

"A wattled work was built across the break in Jetty 21; this was carried away by the next rise in the river. The break was then closed by a mattress-dam, constructed of mats similar to those along the closure dike. Two freshets which have occurred since these works were commenced have caused no material damage.

"The wattled portions of jetties from 5 to 15 inclusive have been repaired. Harbor Jetty 7, a portion of which was carried away by a freshet in 1881, has been extended to the line of the new harbor jetties. One hundred and twenty feet of Lieutenant Run wall, which had also been damaged by freshets, have been rebuilt. In the South Channel wattled jetties have been commenced, to diminish the width of the channel at the shoal, about 5,000 feet from the mouth of Puddledock Cut. A tabulated statement of work performed during the year is appended, marked I.

"In Table II are shown the expenditures to May 31, 1883, giving the amounts expended on the different classes of work. This table has been derived from vouchers that have passed through this office.

"The cost of the different classes of works has been as follows:

"Timber jetties*	per running foot..	$2 34
"Wattled jetties*	do.....	1 47¼
"Mat protection*	per square foot..	07¼

Work has frequently been interrupted by freshets, which have been higher and of longer duration than usual. The only damage caused by them has been the washing away of the wattled portion of Jetty 21, previously mentioned, of a few feet of the deflector, and of 20 feet of Lieutenant Run wall. The latter has not been repaired.

To determine the condition of the river at the close of the fiscal year cross-sections were taken in the Petersburg Channel from the bridge, the head of navigation, to the end of Magazine Bend, at an average distance of 65 feet, below this every 150 feet. Through Puddledock Cut channel soundings were taken, 306 in number.

"In the South Channel cross-sections were taken at distances of 150 feet. All soundings are reduced to the high water usually assumed, 3.32 feet above the plane of the map of 1881. A channel of 12 feet is found from Harbor Jetty 1 to the end of the South Channel with the following exceptions: from Harbor Jetty 10 to the end of Magazine Bend, a channel of 10 feet depth from Jetty 16 to Jetty 19, a channel of 11.8 feet, at the entrance to Puddledock Cut a channel of 10.5 feet. From Station 17 to Station 20, South Channel, a channel of 11.7 feet.

"The turning basin above Harbor Jetty 1 has filled in.

"A comparison of the soundings of 1882 and 1883 show a general improvement of the river with the exception of Magazine Bend.

"Tables III and IV have been prepared to show the condition of the Petersburg and South channels.

"C. McD. Townsend,
"*First Lieutenant of Engineers.*"

TABLE I.

The summary of this table is only here given, by which it appears that during the yea there have been built 2,323 linear feet of timber wing-dams, 1,580 linear feet of wattled work, and that 31,200 square feet of mat protection has been placed. This is exclusive of repairs to nearly 2,000 linear feet of wattled work.

* To end of May, 1883.

TABLE II.

From this table it appears that the expenses for labor and materials upon the various classes of work have been as follows:

Repairs	$2,220 19
Mat protection (a portion of which was actually repairs)	2,615 82
Construction of wattled work	1,577 08
Construction of timber wing-dams	3,425 25

The other expenses were for the completion and running expenses of the tow-boat, rents, office and clerical expenses, watchmen, &c.

TABLE III.—*Showing condition of Petersburg Channel* 1883 *and* 1882.

Location.	Width.	June, 1883.				October, 1882.			
		Width of 12-foot channel.	Greatest depth.	Area of cross-section.	Mean depth.	Width of 12-foot channel.	Greatest depth.	Area of cross-section.	Mean depth.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Harbor Jetty 1	190	50 40	14.9 13.8	1,775.6	9.3	60 50	14.9 13.9	1,993.3	10.7
Harbor Jetty 2	185	70 40	12.8 12.9	1,822 4	9.9	40 40	12.8 12.6	1,555.3	9.1
Harbor Jetty 3	155	60 70	13.7 13.4	1,733.5	11.1	40 20	13.0 12.7	1,616.0	10.4
Harbor Jetty 4	133	30 50	13.0 14.1	1,519.5	11.4	30 40	12.8 13.3	1,388.7	10.4
Harbor Jetty 5	140	80 50	14.6 13.6	1,716.5	12.2	.....	11.9 11.8	1,537.0	11.1
Harbor Jetty 6	133	30 10	12.8 12.6	1,528.4	11.5	 30	11.8 12.6	1,401.9	10.5
Harbor Jetty 7	133	30 50	12.7 13.6	1,422.1	10.7	.....	11.9 11.7	1,230.0	9.3
Harbor Jetty 8	134	40 50	14.8 14.1	1,450.0	10.8	40 10	12.9 12.6	1,361.9	10.1
Harbor Jetty 9	140	50 30	13.4 12.5	1,513.5	10.8	30	12.7	1,429.5	10.2
Harbor Jetty 9½	128	20	12.3 12.5	1,283.3	10.0	.....	.....	.....	.....
Harbor Jetty 10	125	30	11.0 11.2	1,265.5	10.1	10	12.0 11.4	1,168.2	9.1
Harbor Jetty 11	125	30 40	13.6 13.4	1,289.9	10.3	.....	11.4 11.9	1,088.8	8.7
Harbor Jetty 12	125	.....	11.4 10.5	1,211.7	9.6	.....	11.1 11.0	1.164.0	9.3
Harbor Jetty 13	125	.....	11.1	1,210.4	9.7	.....	11.7	1,336.2	10.6
50 feet below 13	150	20	13.2	.....	.....	20	12.3	.....	.....
Angle Lieutenant Run	160	30	13.0	.....	.....	40	12.8	.....	.....
End of Lieutenant Run wall	220	20	12.8	.....	.....	40	13.8	.....	.....

TABLE III—Continued.

Location.	Width.	June, 1883.				September, 1882.			
		Width of 12-foot channel.	Maximum depth.	Area of cross-section.	Mean depth.	Width of 12-foot channel.	Maximum depth.	Area of cross-section.	Mean depth.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Jetty A	155	.....	11.5	1,321.9	8.5	40	12.5	1,471.0	9.8
		10	12.8				11.9		
Jetty B	190	20	12.6	1,500.6	7.9	.....	11.3	1,576.4	8.1
		20	13.4			10	12.0		
Jetty C	155	10	12.3	1,173.5	7.6	10	12.1	1,250.1	8.0
		10	12.5			20	12.6		
Jetty D	173	.....	11.0	1,432.6	8.2	10	12.2	1,282.0	8.0
			10.7			10	12.0		
Jetty E	185	.....	10.9	1,341.2	7.9	10	12.1	1,258.7	7.8
			11.9			20	12.9		
Jetty F	173	10	13.1	1,258.3	7.2	.....	.....	.....	.....
		10	12.3						
Jetty G	157	.....	11.2	1,114.5	7.4	.....	.....	.....	.....
		10	13.4						
Jetty H	163	10	12.7	1,336.2	8.2	.....	.....	.....	.....
			10.2						
Jetty I	140	40	19.2	1,669.6	11.9	40	18.5	1,696.2	12.1
		50	15.9			70	17.4		
Jetty J	150	.....	10.9	1,550.0	10.4	.....	11.7	1,549.5	10.3
			11.6			40	12.6		
Jetty K	150	10	12.2	1,571.5	10.5	40	14.3	1,706.6	11.3
			11.2			10	12.1		
Jetty L	150	.....	11.0	1,505.5	10.0	.....	11.9	1,530.0	10.2
			10.8				11.0		
End of Poor Run wall	144	10	12.6	.....	.....	30	13.0	.....	.....
150 feet from Poor Run wall	240	.....	11.7	.....	.....	.....	.....	.....	.....
300 feet from Poor Run wall	250	.....	11.9	.....	.....	.....	.....	.....	.....
450 feet from Poor Run wall	245	10	12.1	.....	.....	.....	.....	.....	.....
600 feet from Poor Run wall	237	60	13.7	.....	.....	.....	.....	.....	.....
750 feet from Poor Run wall	240	40	14.4	.....	.....	.....	.....	.....	.....
900 feet from Poor Run wall	240	50	14.4	.....	.....	.....	.....	.....	.....

TABLE III—Continued.

Stations.	Width.	June, 1883.				June, 1882.				Remarks.
		Width of 12-foot channel.	Maximum depth.	Area of cross-section.	Mean depth.	Width of 12-foot channel.	Maximum depth.	Area of cross-section.	Mean depth.	
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	
1	160	90 90	13.9 14.7	1,627.3	10.1	80 100	14.5 14.3	.....	.....	
2	177	100 70	14.5 14.5	1,742.8	9.8	100 90	14.5 15.4	.....	.....	
3	173	120 120	14.0 13.1	1,836.9	10.6	110 110	14.5 14.0	.....	.....	
4	160	90 90	13.8 13.3	1,657.3	10.3	80 80	13.4 12.8	.....	.....	
5	153	60 50	18.1 13.1	1,656.9	10.8	60 40	17.0 12.7	.....	.....	
6	150	40 80	15.5 12.3	1,657.0	11.0	40 70	15.6 12.6	.....	.....	
7	150	60 50	19.0 12.3	1,771.2	11.8	50 40	17.8 12.6	.....	.....	
8	150	60 50	18.0 12.9	1,764.0	11.7	60 30	18.0 12.5	.....	.....	
9	150	70 60	19.2+ 14.4	1,714.8	11.4	60 50	18.5 14.7	.....	.....	
10	150	70 50	19.0+ 12.5	1,858.2	12.4	60 40	18.6 12.2	.....	.....	
11	132	60 60	19.0+ 14.0	1,672.4	12.6	50 30	19.0 13.5	.....	.....	
12	130	50 50	17.5 13.7	1,684.1	12.9	30 30	15.7 13.6	.....	.....	
13	137	100 100	18.4 13.0	1,621.6	11.8	40 50	17.5 12.8	.....	.....	
14	140	100 120	19.0+ 14.7	1,712.5	12.2	80 100	18.3 13.8	.....	.....	
15	170	120 10	15.8 12.1	1,880.6	11.0	30	14.8 11.9	.....	.....	
16	170	50	15.4 11.9	1,795.1	10.5	30	15.2 11.3	.....	.....	
17	170	50 70	15.6 12.8	1,896.8	11.1	40 40	17.0 13.0	.....	.....	
18	225	60 10	19.0+ 12.0	2,168.0	10.8	40	16.8 11.5	.....	.....	200 cross-section.
19	200	60 30	16.8 12.4	2,324.0	11.6	30 50	19.0 13.2	2,948.1	14.7	
20	160	60 90	19.0+ 14.5	2,159.5	13.5	60 110	18.0 14.6	2,157.9	13.5	
21	170	50 20	16.8 13.1	2,072.5	11.9	70 50	15.0 13.2	2,228.7	13.1	

TABLE III—Continued.

Stations.	Width.	June, 1883.				September, 1883.				Remarks.
		Width of 12-foot channel.	Maximum depth.	Area of cross-section.	Mean depth.	Width of 12-foot channel.	Maximum depth.	Area of cross-section.	Mean depth.	
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	
22	180	20 20	13.1 12.7	2,020.7	11.2	10	19.0+ 11.5	1,927.4	10.5	Close to closure dike.
23	155	60 110	13.1 13.3	1,142.2	10.6	20 40	12.5 12.5	1,611.3	10.4	
24	146	100 40	13.0 12.5	1,592.9	10.9	30	12.2 11.0	1,490.9	10.6	
Abutment	167	.....	11.6	1,650.9	9.8	.....	10.7	1,477.8	8.8	
End of wall	170	.....	11.1	1,507.6	8.8	10	13.3	1,524.0	8.9	

TABLE IV.—*Showing condition of South Channel,* 1883 *and* 1882.

Stations.	June, 1883.		June, 1882.	
	Width of 12-foot channel.	Maximum depth.	Width of 12-foot channel.	Maximum depth.
	Feet.	*Feet.*	*Feet.*	*Feet.*
0	6	12.9	50	12.3
	30	12.5	.....	11.9
1	50	12.6	10	12.1
	70	13.4	30	12.5
2	60	13.5	60	12.9
	60	13.2	20	12.6
3	40	12.4	50	12.3
	20	12.3	40	12.3
4	50	12.3	10	12.0
	50	12.1	20	12.1
5	30	12.3	20	12.1
	50	13.0	50	12.2
6	70	13.0	60	12.8
	80	14.0	60	14.0
7	80	14.0	70	13.6
	80	13.1	60	12.8
8	80	13.1	50	12.9
	70	13.3	60	12.9
9	70	14.2	60	13.7
	80	13.8	70	13.5
10	70	13.7	70	12.6
	80	13.0	20	12.0
11	80	12.7	.....	11.9
	70	12.4	.....	11.8
12	80	12.3	.....	11.7
	70	12.7	10	12.0
13	90	13.4	40	12.3
	80	13.4	30	12.6
14	80	13.5	60	12.4
	90	13.6	70	12.6
15	100	13.6	80	12.6
	100	14.0	70	13.5
16	80	13.5	80	13.6
	80	12.6	.....	11.9
17	50	12.4	20	12.0
	20	13.3	.....	11.8
18	.....	11.9	.....	11.7
	10	12.0	.....	11.6
19	.....	11.8	.....	11.7
	10	12.0	.....	11.4
20	10	12.0	.....	11.7
	30	12.2	.....	11.7

TABLE IV—Continued.

Stations.	June, 1883.		May, 1882.	
	Width of 12-foot channel.	Maximum depth.	Width of 12-foot channel.	Maximum depth.
	Feet.	*Feet.*	*Feet.*	*Feet.*
21	80	12.4	20	12.2
	80	13.0	50	12.3
22	80	12.8	30	12.3
	100	13.2	60	12.9
23	90	13.9	80	13.0
	80	13.5	70	13.2
24	70	13.7	60	13.0
	80	13.0	60	13.0
25	70	13.1	50	12.9
	70	12.8	50	13.0
26	70	12.7	50	12.3
	70	12.6	40	12.0
27	60	12.6	.....	11.9
	60	12.8	20	12.1
28	70	13.4	40	12.7
	70	13.5	50	13.0
29	60	13.5	40	12.9
	50	13.4	30	13.0
30	40	12.9	40	12.3
	70	14.0	40	12.4
31	70	14.7	60	13.8
	90	15.2	70	14.5
32	90	14.8	90	14.0
	90	15.4	80	14.8
33	90	15.4	80	14.5
	90	14.7	90	14.1
34	100	14.6	100	13.9
	90	14.9	100	14.2
35	100	13.4	80	12.4

From estimates made by Lieutenant Townsend it is found that the excavation of 20,960 cubic yards would be required to give a channel 40 feet in width and 12 feet in depth (with 1 foot allowance for deep digging) from the bridge to the mouth of the river, while the excavation of 50,511 cubic yards would give a channel 80 feet in width, with 12 feet depth, and the same allowance for digging.

Recent examinations show that much less work will be required in the South Channel than has heretofore been estimated for; 2,800 cubic yards of dredging will give a channel 40 feet in width, and 7,240 cubic yards a channel 80 feet in width, of the standard depth. The partial contracting works now in course of construction will cost about $3,200.

The banks on the north shore of the Magazine Bend are now wearing away, and if it be the intention to retain the channel round this bend, a contracting dike should be built and the wattled dike should be protected from underscour. The shore opposite jetties 17 to 20 is receding at a rapid rate and a contracting dike is necessary. There are indications on the plotted cross-sections also that this shore below Hare's Dike is beginning to scour, and the means should be at hand to prevent this from becoming serious.

The scouring of these shores indicates that in contracting a stream the concave shore, if scourable, should at the outset be so protected as to prevent it.

It is deemed judicious that the work in the coming year should be limited to the following if the width of channel be 80 feet, disregarding Stein's Cut:

South Channel Works	$3,200 00
Dredging in the South Channel, 7,240 cubic yards, at 30 cents	2,172 00

Dredging at head of Puddledock Cut, 2,000 cubic yards, at 30 cents	$600 00
Dredging between Magazine Bend and the head of Puddledock Cut, 9,035 cubic yards, at 30 cents	2,710 50
Dike opposite jetties 17 to 20, 1,000 linear feet with mat protection, at $3.50	3,500 00
Dike below Hare's Dike if found needful, 600 linear feet, at $3.50	2,100 00
Dredging in Magazine Bend, 21,700 cubic yards, at 30 cents	6,510 00
Dike in Magazine Bend, 1,200 linear feet, at $3.50	4,200 00
Mat protection of wattled dike, 1,200 linear feet, at $1	1,200 00
Dredging above Magazine Bend, 10,830 cubic yards, at 30 cents	3,249 00
Extending Phillips' Wing Dam, 800 feet, at $3.50	2,800 00
Repairs and maintenance, one year	5,000 00
Contingencies, &c	5,758 50
Total	43,000 00
Balance on hand	22,479 41
Amount to be appropriated to do this work	20,520 59

A channel 40 feet in width would require 29,551 cubic yards less dredging, and the amount to be appropriated would be reduced to $11,520.59.

If it is desired by Congress to reopen Stein's Cut the above amounts should be increased by the sum of $59,290.

Very respectfully,

THOMAS TURTLE,
Captain of Engineers.

Lieut. Col. WM. P. CRAIGHILL,
Corps of Engineers, U. S. A.

2.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., July 13, 1883.

COLONEL: The following memorandum is presented in regard to the estimates for completing the existing project for the Appomattox River, and explanatory of the differences which may be found to exist between the estimates of the reports of the last and the present years.

The estimates last year were made up as follows:

To include the opening of Stein's Cut:

For South Channel, as per last Report, page911	$40,000 00
For Petersburg Channel, Stein's Cut opened, as per Report	80,000 00
For the harbor of Petersburg, as per Report	4,100 00
For dredging, repairs, &c., after the spring freshets, with other expenses for the year	8,000 00
Total	132,100 00

Stein's Cut not being opened:

For South Channel, as above	40,000 00
For harbor of Petersburg, as above	4,100 00
For Petersburg Channel, as per Report, page 911	13,898 94
For dredging, &c., as above	8,000 00
	65,998 94

Recent cross-sections of the South Channel indicate a depth greater than reported at previous examinations, and the works, therefore, now recommended are of much less extent than formerly thought needful; the estimates have on that account to be modified. A large part of the new works estimated for last year have been built; no dredging has been done, and changes in the shores at Magazine Bend and from Hare's Dike to opposite jetty 20 introduce new conditions. To meet the circumstances now existing the estimate of this year's report was made. No account was taken of the amount required for maintenance during the succeeding year, as a session of Congress intervenes, at which any needful appropriation can be made.

The estimates of this year are summarized as follows:

Stein's Cut not to be opened: Channel dredged to 40 feet width, estimate	$34,000
Stein's Cut not to be opened: Channel dredged to 80 feet width, estimate	43,000

Stein's Cut to be opened: Channel dredged to 40 feet width, estimate	$93,290
Stein's Cut to be opened: Channel dredged to 80 feet width, estimate	102,290

Respectfully submitted.

THOMAS TURTLE,
Captain of Engineers.

Lieutenant-Colonel CRAIGHILL,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

The following table exhibits the comparative tonnage of the port of Petersburg for the first six months of the years 1882 and 1883:

First six months, 1882.			First six months, 1883.		
Class.	No.	Tonnage.	Class.	No.	Tonnage.
Schooners	136	13,832.59	Schooners	140	15,591.49
Sloops	35	376.37	Sloops	23	259.77
Steamers	111	4,164.26	Steamers	89	3,223.89
Steam tugs	165	2,799.96	Steam tugs	235	3,296.68
	447	21,173.18		487	22,371.83

E. H. STAINBACK,
Port Warden.

PETERSBURG, *July* 7, 1883.

COMMERCE OF THE PORT OF PETERSBURG.

Number of vessels from 1877 *to* 1882, *inclusive.*

Vessels.	1877.	1878.	1879.	1880.	1881.	1882.
Schooners	176	188	206	208	175	261
Sloops	118	126	82	75	53	83
Steamers	10	14	14	40	74	225
Steam tugs	288	269	238	348	295	348
Barges	51	69	44	80	48	.....
Total	643	666	584	751	645	917

Tonnage of vessels from 1877 *to* 1882, *inclusive.*

Vessels.	1877.	1878.	1879.	1880.	1881.	1882.
Schooners	11,996.60	13,472.60	14,334.91	19,085.27	26,826.95	28,726.15
Sloops	1,242.20	1,216.49	777.22	681.48	463.16	876.22
Steamers	975.95	1,648.92	734.29	2,165.07	3,274.03	8,492.75
Steam tugs	4,053.87	3,350.06	3,673.64	5,690.46	4,474.51	5,866.43
Barges	2,762.71	2,614.28	1,815.78	3,010.24	929.11	.....
Total	21,031.03	22,302.35	21,335.84	30,632.53	35,967.76	43,961.55

LETTER OF THE CHAIRMAN OF THE RIVER COMMITTEE OF THE CHAMBER OF COMMERCE OF PETERSBURG, VIRGINIA.

PETERSBURG, VA., *August* 16, 1883.

DEAR SIR: In compliance with your request to furnish you "such commercial statistics of the port of Petersburg as will be useful to accompany the Annual Reportof the Chief of Engineers upon the Appomattox River, Virginia," I requested Mr. E. H. Stainback, our port warden, to furnish the tonnage of the port and the value of the freights received at or sent from this city by way of the Appomattox. His official communication recently sent you under a resolution of our common council gives the information desired from this officer. I send herewith a printed copy of his letter.

* * * * * * *

Very respectfully,

GEO. S. BERNARD,
Chairman River Committee, Chamber of Commerce.

Lieut. C. MCD. TOWNSEND,
Corps of Engineers, U. S. A.

LETTER OF THE PORT WARDEN OF PETERSBURG, VIRGINIA.

PETERSBURG, VA., *August* 2, 1883.

DEAR SIR: Pursuant to a resolution of the common council of the city of Petersburg I now send you the tables below, giving you statistical information as to the commerce of the port of Petersburg. Table A shows the tonnage of the port from January 1, 1877, to June 30, 1883. Table B shows the articles of freight received at or sent from the port by way of Appomattox River, with the values thereof, at the city of Petersburg, during the years 1880, 1881, and 1882.

TABLE A.—*Tonnage of the port of Petersburg from* 1877 *to* 1881, *inclusive.*

NUMBER OF VESSELS.

Vessels.	1877.	1878.	1879.	1880.	1881.	1882.	January 1 to June 30, 1883.
Schooners	176	188	206	208	175	261	140
Sloops	118	126	82	75	53	83	23
Steamers	10	14	14	40	74	225	89
Steam tugs	288	269	238	348	295	348	235
Barges	51	69	44	80	48	.....	.....
Total	643	666	584	751	645	917	487

TONNAGE OF VESSELS.

Vessels.	1877.	1878.	1879.	1880.	1881.	1882.	January 1 to June 30, 1883.
Schooners	11, 996. 60	13, 472. 60	14, 334. 91	19, 085. 27	26, 826. 95	28, 726. 15	15, 591. 49
Sloops	1, 242. 20	1, 216 49	777. 22	681. 48	463. 16	876. 22	259. 77
Steamers	975. 95	1, 648. 92	734. 29	2, 165. 07	3, 274. 03	8, 492. 75	3, 223. 89
Steam tugs	4, 053. 87	3, 350. 06	3, 673. 64	5, 690. 46	4, 474. 51	5, 866. 43	3, 296. 68
Barges	2, 762. 71	2, 614. 28	1, 815. 78	3, 010. 24	929. 11	.....	.....
Total	21, 031. 03	22, 302. 35	21, 335. 84	30, 632. 53	35, 967. 76	43, 961. 55	22, 371. 83

TABLE B.—*River commerce of the port of Petersburg (values of articles of freight).*

INWARD FREIGHTS.

Articles.	1880.	1881.	1882.
Coal	$65,222	$60,610	$87,046
Corn	34,500	56,375	109,592
Wheat	8,700	6,093	39,398
Oats	.....	875	4,400
Hay, straw, &c	10,300	7,488	7,372
Ice	33,010	15,300	33,360
Guano	218,322	265,625	173,480
Plaster	4,000	1,200	1,680
Salt, agricultural	.....	1,041	5,600
Salt, Liverpool	2,800	2,038	3,806
Lime, builders'	1,923	.....	.....
Lime, prepared	.....	.....	1,344
Lime, shell	4,600	1,430	1,000
Peanuts	12,120	48,985	60,000
Potatoes	2,625	2,602	2,604
Pig-iron	.....	1,110	938
Pine lumber	.....	850	.....
White pine	.....	272	.....
Oysters	.....	1,800	2,856
Sumac	.....	745	.....
Oyster shells	183	1,274	1,520
Sycamore lumber	13,287	43,496	33,880
Total	412,642	519,209	569,876

OUTWARD FREIGHTS.

Articles.	1880.	1881.	1882.
Pine lumber	$35.000	$45,159	$56,227
Oak lumber	12,360	12,361	16,205
Gum lumber	.....	1,200	9,052
Poplar lumber	.....	.....	660
Railroad ties	4,234	3,933	5,566
Pine wood	13,200	16,008	36,940
Poplar wood	.....	710	1,001
Staves	9,930	.....	.....
Barrels	.....	783	2,100
Cotton seed	.....	.....	2,579
Stable manure	.....	.....	1,433
Miscellaneous	.....	.....	50,000
Total	74,724	79,154	179,563

SUMMARY.

Commerce.	1880.	1881.	1882.
Inward commerce	$412,642	$519,209	$569,876
Outward commerce	74,724	79,154	179,563
Total	487,366	598,363	749,439

By a glance at the foregoing tables it will be readily seen that the tonnage of this port, as well as the river commerce, both inward and outward, for the year 1882, largely exceeds the same for the two previous years. The indications are that there will be a large augmentation for the present year (1883) as compared with the year 1882.

Very respectfully,

E. H. STAINBACK,
Port Warden.

Lieut. C. McD. TOWNSEND,
Corps of Engineers, U. S. A.

H 22.

IMPROVEMENT OF SHENANDOAH RIVER, WEST VIRGINIA.

Congress granted $15,000, June 14, 1880, for the portion of the river in West Virginia which includes the single county of Jefferson. A second appropriation of $2,500 was made March 3, 1881, but a proviso to the latter prohibited the expenditure of either until the surrender to the United States of any corporate rights or franchises over the river held under State authority.

After considerable delay an opinion was given in June, 1883, by the United States district attorney for West Virginia, that the conditions imposed by Congress had been satisfied. Should the Secretary of War approve, the work could be begun.

Money statement.

July 1, 1882, amount available	$17,312 20
July 1, 1883, amount available	17,312 20
Amount (estimated) required for completion of existing project	7,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	7,500 00

H 23.

IMPROVEMENT OF NEW RIVER FROM THE MOUTH OF WILSON, IN GRAYSON COUNTY, VIRGINIA, TO THE MOUTH OF THE GREENBRIER RIVER, IN WEST VIRGINIA.

The operations on this river in 1882 began in June and ended in October. A detailed account of them is given in the appended report of Col. William Proctor Smith, assistant engineer.

When work on the river ceased in October, 1882, the property pertaining to each division was placed in store, as usual, in charge of a watchman. The assistant engineer was then brought to Baltimore and employed in preparing his report of past work, making drawings showing the condition of the river at the close of the operations of the season and the progress of the improvement, with estimates of the cost of what yet remains to be done for its completion.

When Congress adjourned, March 3, 1883, without provision for work in 1883, it was deemed best and most economical, instead of keeping the property in store at considerable expense for a long time, to collect it at some convenient place and dispose of it. Hinton was the point selected. The day of sale was April 25, 1883, and the amount realized $415.26, which was turned into the Treasury, in conformity to law. The assistant engineer was, with regret, discharged at the end of May. His services have been of much value.

It has hardly been practicable to accomplish at any one of the very many points needing improvement all that has been desirable, but the worst places have been worked upon to the greatest extent, and efforts thus been made to increase the available navigability of the river over as long stretches as possible, and to increase the facilities for access of the greatest number to the railroads touching the river, and thus connecting with the eastern and western markets districts otherwise much isolated and hitherto dependent on teaming to railroad stations over long and bad roads.

Should work be resumed, it will be found difficult to collect and or-

ganize as efficient a force as that which has been disbanded and necessarily scattered. To replace such a machine takes time and money.

The statements and statistics in Colonel Smith's report below indicate the value of what has been accomplished. Of the available balance of funds almost the whole pertains to the Lead Mines division, on which it has not been expedient to work during the fiscal year.

Money statement.

July 1, 1882, amount available	$3,506 10
Amount appropriated by act passed August 2, 1882	12,000 00
	15,506 10
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	12,419 44
July 1, 1883, amount available	3,086 66
Amount (estimated) required for completion of existing project	169,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	50,000 00

REPORT OF COLONEL WILLIAM PROCTOR SMITH, ASSISTANT ENGINEER.

BALTIMORE, MD., *May* 21, 1883.

COLONEL: I have the honor to submit the following report of operations on the improvement of New River, Virginia and West Virginia, for the fiscal year ending June 30, 1883.

GREENBRIER DIVISION.

Work began June 20, 1882, and ended October 31. Out of one hundred and fifteen working days, fifty-one were lost, nineteen from want of funds in July and August, and the remainder from high and muddy water. The surveys and storing were finished late in December. Only one party, of about thirteen men, was employed. Highest water 11.8 feet above, and lowest 0.2 foot below, zero. Nine-tenths of the time the gauge readings were above ordinary low water. Four distinct rises occurred, delaying operations very much. The greater part of the labor was expended on Wiley's Falls, which consisted in making a cut through hard sandstone, interspersed with iron pyrites, 184 feet long, 50 feet wide, and 3 feet deep, with a fall of 3.58 feet. Originally the grade was 1.95 feet in 100 feet, but is now reduced to 0.72 foot, obtained by deepening the channel and extending the wall, on the river side, made from the material excavated, to a length of 495 feet, 13 feet wide, and 4 feet high, with another on the land side 274 feet long, of the same width and depth as the former.

The work at Kidwell's Ripple and Wiley's Shoals was, for the most part, done with the crane-boat.

Total length of walls 1,141 feet, 12 feet wide and 3½ feet high. River space worked over 1½ miles, fall in the same 5.83 feet, giving a channel from Hinton to Wiley's Shoals, 26½ miles, 50 feet wide and 2 feet deep; total fall in the entire distance, 104.26 feet, and fall over ledges and shoals 91.98 feet. Actual cutting through ledges, 47.875 feet.

The project for the season called for some work at Warford Shoals and Indian Creek, but as it was found that boats could get through these places very well, and that the work would not be injured by letting them alone, and Wiley's Falls being considered more important, the money was expended there, and, as the work was greater than anticipated in the project, there was no money left for the few shoals above that were estimated for this season.

Whilst the men in bad weather could not work, the boat's crew and some other labor was used in making a more careful survey of the line of the proposed channel through Shumate's Falls, as well as to sink test pits to ascertain the quality of the material to be taken out. This work was done to employ the party and to anticipate a call for a project for the improvement of these falls before the weather would be suitable to make the necessary examinations. A map on a scale of 100 feet to the inch has been prepared, together with a profile of the channel, from which a revised estimate has been made, giving the total cost of the work, in round numbers, at $11,000. The same method of improvement is recommended as suggested in my report for the fiscal year ending June 30, 1882.

A careful survey was also made of the bank of the river at and below Wiley's Falls, with cross-sections every 50 feet, showing its exact condition previous to cutting the channel, to note in the future whether any damage had resulted therefrom.

On the improved part of the river, in this division, there are nine saw-mills, employing eleven keel-boats and numerous rafts, which cut in 1882 2,000,000 feet of lumber, 1,800,000 oil barrels, and 100,000 pipe staves, besides twenty car loads of walnut and as many of locust. Their capacity is from 10,000 feet to 25,000 feet per day. In addition to the above there are six keel-boats on this section of the river, making seventeen in all.

Round Bottom or Pennington's Ferry, 24½ miles above Hinton, is becoming an important place, as the most of the tobacco, grain, &c., from that part of Mercer County is being shipped from that point.

The stave business is following the improvement very closely; a bucking machine is now in operation just below Round Bottom.

The improvement, when it reaches a point 35 miles above Hinton, will give outlet to Peterstown, Monroe County, West Virginia, a thriving place, about 2½ miles from the river, at which there are three mills with a capacity of 58 barrels of flour and one hundred and twenty bushels of meal per day, three tanneries using 1,500 hides per annum, three stores, one saw-mill, and one cabinet shop.

NEW RIVER BRIDGE DIVISION.

Work commenced June 8 and ended September 25; only worked forty days out of a possible ninety-eight. Bad weather, high and muddy water, and lack of funds account for the loss of time. One party of about fifteen men, with one overseer for the whole work, was employed. Highest water 7.4 feet above and lowest 0.25 foot below zero. The gauge reading was below zero for only twenty-three days during the season. Worked over a river space of 8 miles, with a fall over shoals and ledges of 36.37 feet, from the head of Jones' Ford to a point in Pine Run Shoals, 1⅛ miles from their foot, one-third of a mile from their head, and, 29¼ miles from New River Bridge, with a channel 10 feet wide and 2 feet deep. To finish Pine Run Shoals will require cutting through four ledges, about 15 feet wide, and give outlet to Barren Spring Furnace, 30.9 miles above the bridge. Character of rock, limestone and red shale.

The channel gives outlet to Reed Island Creek Furnace at the mouth of Big Reed Island Creek, 26¾ miles above the initial point. In the 8 miles referred to seventy-three ledges were encountered, twenty-seven of which were improved for the 10-foot channel, and nearly all will have to be worked at when the 20-foot channel is made, which should be as soon as Barren Spring Furnace is reached; to do this, it is thought it will be best to go back to the beginning of the 10-foot channel, at the foot of Cecil's Ledges, 14½ miles above the bridge. The increased width is rendered necessary in some places where there is loose rock and gravel, as 10 feet is not wide enough for the current to keep the channel clear; as, for instance, at Jones' Ford and Crumm's Shoals; in fact, the narrow channel was only adopted to give temporary relief to the furnaces.

Total fall from the head of Pine Run Shoals to New River Bridge, 143 feet; fall over shoals and ledges in that distance 129.89 feet; length of walls, 874 feet, 5 feet wide and 2½ feet high.

Owing to the long distance worked over, the frequent removal of camp, and bad weather, the work cost about twice as much as last season.

Something over 900 tons of pig iron were shipped from Reed Island Furnace, 26¾ miles above New River Bridge, to the Norfolk and Western Railroad at the latter point, and 256 tons from Radford Furnace, 18 miles above the bridge.

Eight keel-boats on this division, with a small side-wheel steamboat, 75 feet long, 8 feet wide, and drawing 3 feet, eighteen charcoal furnaces, four forges, four zinc mines, one lead mine, and many deposits of copper await shipment by the river, and vast forests of the most valuable timber, on the upper division, are kept from market by the non-completion of this work.

LEAD MINES DIVISION.

No work this season, but inspections of the property stored at Wilkinson's Forge, Carroll County, Virginia, were made every sixty days.

Average cost of rock per cubic yard, $2.67, an increase over 1881 of 42 per cent. Cost of gravel, $1.22 per cubic yard.

Taking the total number of cubic yards of material, measured in the walls, removed since the commencement of the work in 1877, and dividing it into the total amount of money expended in that time, it is found that it only cost $2.42 per cubic yard, which shows that the work has been conducted in a very economical manner.

Total number of miles of river improved, 61. The high price of supplies—bacon 20 cents and flour 5 cents per pound—made labor command 12 cents per hour to September 15, and 12½ cents thereafter.

On the 8th of March instructions were received from you to have all of the property belonging to the improvement taken to Hinton, W. Va. On the 17th of March, J. F. Palmer, to whom much praise is due for the efficient manner in which he carried on his work as superintendent last season, as well as for the energy and ability displayed in this movement, commenced that work, and after much difficulty, on account of the weather, low water, and scarcity of labor, succeeded in getting it all at the proper point on the 14th of April, and on the 25th, by your orders, a sale was held, at which everything belonging to the Government was disposed of to the highest bidder.

Of the freight sent from Hinton in 1882, 95 per cent. came from New River, an increase over 1881 of 46 per cent.

Of the freight received at Hinton in 1882, 43 per cent. went up the river. Twenty-four and a half per cent. increase on shipments from Hinton in 1882 over 1881. Nine per cent. increase on freight received at Hinton in 1882 over 1881.

In the same order as above, the percentage at Lowell and Hinton stations, Chesapeake and Ohio Railway, combined, were, respectively, 92½, 46, 14, and 55.

The shipments from the various stations on the Norfolk and Western Railroad, tributary to the river, were not received from the auditor, owing to want of time to prepare them, which is much to be regretted, as it is desirable to have comparisons annually.

The tables show the details of the work for the past season, as well as the commercial statistics for the lower division.

Three maps, on a scale of 100 feet to the inch, show the details of the work and surveys at two shoals and two falls on the Greenbrier division, and four maps, on a scale of 200 feet to the inch, show the work at eight shoals and ledges on the Middle or New River Bridge division. The gauge readings on each division were also plotted.

From Hinton, W. Va., to mouth of Wilson Creek, Virginia, the extent of this work is 191¼ miles.

Lower Division, 86½ miles; improved, 26⅛ miles.
Middle Division, 43 miles; improved, 29¼ miles.
Upper Division, 62 miles; improved, 5⅛ miles.
Total, 191¼ miles; total improved, 60.78 miles.

June 30, 1882, there was a channel 50 feet wide and 2 feet deep from Hinton Landing to Kidwell's Ripple, a distance by river of 25⅑ miles; at the close of the working season for 1882, there was a channel of the same width and depth to Wiley's Shoals, a distance of 26½ miles.

June 30, 1882, there was a channel from New River Bridge to the head of Jones' Ford, a distance of 21 miles, 12 miles 30 feet, 2⅓ miles 20 feet, and 7½ miles 10 feet wide, and 2 feet deep. During the season for work, 1882, this channel was extended 8¼ miles, to a point above the bridge, 29¼ miles, with a width of 10 feet, and 2 feet deep. No appropriation for the year ending June 30, 1884.

The tables give an exhibit of the commerce of the river in 1882, an increase of nearly 50 per cent.

On the entire river there are twenty-five keel-boats and one small side-wheel steamboat.

Respectfully submitted.

WM. PROCTOR SMITH,
Assistant Engineer.

Lieut. Col. WM. P. CRAIGHILL,
U. S. Engineers.

TABLE No. 1.—*Showing the distances from steamboat landing at Hinton, West Virginia, to foot of shoals or ledges, their length, and difference of level between the head and foot of same; also the quantity and quality of material excavated in making and improving the channel in* 1882.

Shoal or ledge.	Distance.	Length.	Fall.	Solid rock and bowlders.	Gravel.	Total.
	Miles.	*Feet.*	*Feet.*	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*
Hinton to head of Pennington's Shoals...	25	46, 745	86. 15	.....	.....	106
Kidwell's Ripple	25⅑	170	. 60	106	.....	1, 545
Wiley's Falls.....	26	495	3. 58	1, 505	40	126
Wiley's Shoals	26½	465	1. 65	126	.....	
Total	.....	47, 875	91. 98	1, 737	40	1, 777

TABLE No. 2.—*Showing the same as No.* 1 *for the Middle Division, with New River Bridge, Virginia, as the initial point,* 1882.

Shoal or ledge.	Distance.	Length.	Fall.	Solid rock and bowlders.	Gravel.	Total.
	Miles.	*Feet.*	*Feet.*	*Cu. yds.*	*Cu. yds.*	*Cu. yds.*
Shoals to the head of Jones' Ford	21	42,181	89.52	22	.....	22
Nunn's Ledges	21 1/3	3,000	2.98	14	.....	14
Clark's Falls	22 3/8	240	2.51	40	.....	40
Clark's Ledges	22 1/2	220	2.31	12	.....	12
Lake Island Shoals	23	3,100	6.51	42	.....	42
Breeden's Ledges	24 5/8	750	2.00	.....	.....	.....
Crumm's Shoals	26	2,640	6.92	78	74	152
Howard's Ledges	26 3/16	4,200	1.93	.....	.....	.....
Pine Run Ledges and Shoals	27 7/8	7,800	11.21	53	.....	53
Total	.....	64,131	125.89	261	74	335

TABLE No. 3.—*Showing the details of blasting on New River, Virginia and West Virginia, in* 1882.

Subject.	Division.		Total.
	Lower.	Middle.	
Number of holes drilled	548	322	870
Number of feet of drilling	1,186	636	1,822
Number of blasts fired	577	342	919
Number of blasts missed	4	12	16
Number of blasts fired under bowlders	25	8	33
Average depth of holes, feet	2.16	1.98	2.07
Average drilling per day per drill, feet	12.8	12.00	12.40
Average charge of powder, pounds	0.51	0.39	0.45
Average loosening of rock per blast, cubic yards	1.60	1.00	1.30

TABLE No. 4.—*Statement of tonnage sent from and received at Hinton and Lowell stations, on the Chesapeake and Ohio Railway, from January* 1, 1882, *to January* 1, 1883.

[Furnished by ROBERT H. FISHER, Auditor.]

(In tons of 2,000 pounds.)

Articles.	Hinton.		New River.		Lowell.		New River.	
	Sent.	Received.	From—	To—	Sent.	Received.	From—	To—
Lumber	8,153.01	286.61	7,975.00	.....	1,188.83	68.90	.....	.....
Wood	.....	12.00	.....	.....	.....	.....	.....	.....
Coal	.....	954.48	.....	.....	.....	73.79	.....	.....
Salt	1.13	254.58	.10	120.00	.14	101.28	.....	50.14
Other mineral	.....	.....	.....	.....	.....	.27	.....	.....
Bacon	3.06	54.50	2.06	25.00	.39	46.21	.....	30.10
Butter	1.45	.17	.65	.....	.60	.....	.....	.....
Cattle	15.00	.....	.....	.....	707.25	22.00	102.50	.....
Eggs	.21	.....	.09	.....	.....	.....	.....	.....
Hogs	.20	.04	.....	.....	1.05	.....	.....	.....
Horses	32.75	2.00	.....	.....	13.75	15.00	6.90	.....
Lambs	.....	.....	.....	.....	3.20	.....	.....	.....
Lard	.05	5 20	.02	2.45	.....	.86	.....	.40
Sheep	.....	.....	.....	.....	66.00	.....	.....	.....
Wool	7.93	.....	7.00	.....	5.34	.....	3,20	.....
Corn	30.47	374.35	30.47	300.10	18.21	208.07	.....	40.00
Dried fruit	.69	.....	.45	.....	.18	.60	.09	.30
Flour	8.82	335.39	.....	190.54	6.19	171.32	.....	101.00
Wheat	9.99	6.38	9.10	.....	.33	3.50	.....	.....
Flaxseed	.36	.....	.30	.....	.25	.....	.25	.....
Hay	11.12	141.38	11.12	100.38	10.18	76.30	.....	40.00
Leaf-tobacco	133.80	.....	133.10	.....	86.50	.....	80.50	.....
Oats	.15	1.15	.15	1.00	.....	4.05	.....	.....
Manufactured tobacco	1.56	4.80	.76	1.65	.....	2.36	.....	1.95
Whisky	.30	13.01	.....	7.45	.29	17.02	.....	17.02
Merchandise, sundries	104.90	732.04	45.60	530.00	29.72	654.81	.....	450.50
Carbon oil	.03	35.39	.....	22.14	.....	15.99	.....	7.50
Cement	.....	27.30	.....	21.05	.60	29.78	.....	29.78
Lime	1.22	25.11	.....	5.50	.....	2.10	.....	1.90
Sundries	247.40	500.48	110.05	300.18	52.68	133.47	25.00	100.10
Total	8,765.60	3,766.36	8,326.02	1,627.44	2,191.68	1,647.68	218.44	870.69

REPORT OF CAPTAIN THOMAS TURTLE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., October 29, 1880.

MAJOR: I have the honor to transmit herewith a copy of the profile of the New River, West Virginia, according to the slackwater survey of 1874, made by Mr. Charles Humphreys, assistant engineer, showing at numerous localities the highest points attained by the freshet of September, 1878, as found by him from a personal examination subsequent to the flood. These points of highest water are shown by red crosses upon the profile, and reference is made to the level of the railroad and of other objects, and to the authority for each particular point. Upon the last sheet of the profile there are also noted the elevations of the summit of this freshet with reference to the railroad at several places from Paint Creek Depot to Kanawha Falls; the relative heights of this flood and the flood of 1861 at Clifton and at the Kanawha Falls Hotel; the relative heights of several floods in the Gauley River at the mouth of Twenty-Mile Creek, including the floods of 1861 and 1878; and the elevations of the summit of the 1878 flood in the Greenbrier with reference to the railroad at Lowell and at Talcott stations, with the relative heights of this flood and that of 1861 at Lowell Station.

This flood of 1878 is the highest known on the New River, and on the Kanawha from the Great Falls to Coalburg. Below this latter point the flood of September, 1861, is the highest known. In the 1861 freshet the Elk, Coal, and Ohio rivers were much higher than at the time of the 1878 flood, which accounts for the former being the higher upon the lower Kanawha River.

Captain Cuyler, Corps of Engineers, in an inspection report, dated September 19, 1878, reports the flood as rising 30 feet at his encampment near the New River Bridge, in Southwest Virginia.

At Joseph Hinton's store, above the Hinton Depot, the flood of 1878 was higher than that of 1861 by 5 feet, 3.8 feet higher about 3 miles below Hinton, 6 feet higher at the foot of Richmond Falls, 10 feet at Fayette, nearly 10 feet at Hawk's Nest, $3\frac{1}{4}$ feet at the Kanawha Falls Hotel, and 2.12 feet higher at Clifton; while at Charleston the flood of 1861 was the higher by 5.24 feet.

The measurement of the discharge in the flood of 1878 was not attempted, but from the data at hand I think that it may be estimated with a close approximation.

The discharge of the flood of January 16, 1877, which reached a gauge reading of 35.7 feet at Charleston (about 6 feet lower than the flood of September, 1878), was measured, when the water was rising, between the gauge readings of 34.5 feet and 34.75 feet. The discharge was found to be 155,388 cubic feet per second. The measurement of velocity was made by mid-depth floats (21 in number), and the discharge was calculated by the Humphreys-Abbot formula; measurement made and discharge calculated by Mr. A. M. Scott, assistant engineer.

The elevation of the highest point of this 1877 rise at Charleston was 590.196 feet. At Lock 5 (in the same pool) the reference of the highest point of this rise was 594.24 feet. The difference of level was then 4.044 feet; the horizontal distance between gauges was 48.330 feet. The area of the cross-section of the river when at the highest point, at the place where the measurement was made, was 28.375 feet. Assuming this area constant between the Charleston and the Lock 5 gauges, the slope to the ratio $\frac{4.044}{48.330}$; and using the Humphreys-Abbot formula $v = ([225r, s\frac{1}{2}]\frac{1}{4} - 0.0388)^2$ assuming $p = 1.015$ w, the estimated mean velocity is 6.002 feet per second. The slope assumed is too great, because when the Charleston gauge read the highest the water had already fallen at Lock No. 5, 9 miles above. At the time of measurement the mean velocity found was 5.69115 feet. We know that the maximum discharge and consequently the maximum velocity occurs before a flood reaches its highest. For our purposes we will assume the discharge measured in the flood of January, 1877, to be the maximum for that flood, and the velocity, 5.69115 feet, the velocity corresponding thereto.

In the freshet of September, 1878, the difference of level between the highest points reached at Lock 5 and Charleston was 7.906 feet. Assuming the slope of the banks to be 45° between the levels of these two floods, the area of the river section at the point where the former flood was measured would be 32,888 square feet. Making the same suppositions as in the former case, we will find the estimated mean velocity to be 7.614 feet per second. We may now for our purposes assume the following proportion, viz: That the mean velocities when the floods were at their highest as estimated above are proportional to the mean velocities at the instants of maximum discharges. We will have then 6.002 : 7.614 : : 5.7 : 7.232—the fourth term being approximately the mean velocity at the time of maximum discharge for the flood of 1878.

In the former flood (1877) the area of the river section at the time of the assumed maximum discharge was 27,620 square feet. If we assume that the sectional areas when the floods were at their highest are proportional to the sectional areas at the times of maximum discharges, we will have 28,375 : 32,888 : : 27,620 : 32,013—the fourth term of which we assume to be the sectional area at the time of maximum discharge

in the flood of September, 1878. We will thus obtain $32,013 \times 7.232 = 231,518$ cubic feet for the approximate maximum discharge of that flood.

Mr. N. H. Hutton in his report to you on the New River survey of 1874 states that the freshet of 1861 was admitted by the few old settlers scattered throughout the valley to be the greatest known for forty years. To approximate to its discharge in the New River region he made reference to its reported observed heights of 8 feet just above the crest of Richmond Falls. (See Report of Chief of Engineers, 1877, Part I, page 730.) He thus estimated its volume at about 90,000 cubic feet per second, but from other indications thought this excessive.

Mr. Humphrey's note on the profile herewith states that the highest reading of the 1878 flood on the gauge at the head of Richmond Falls was 12.5 feet and that it was at least 12 feet above the crest of the falls. With the same suppositions that Mr. Hutton made, a flood of 12 feet on the crest of these falls would discharge 166,240 cubic feet per second. The Hinton gauge read 20.4 feet (about) above low water. If we here assume a depth of 20 feet, width of channel 1,000 feet, and a slope parallel to the low-water slope from the point on the profile where the elevation of the water surface is indicated as being 1,346 feet to the point where it is indicated as being 1,342 feet, a distance of about 3,600 feet, the discharge would be about 176,000 cubic feet per second. An examination of the profile and map (sheet No. 1 of 1874 survey) will show several reasons for discrepancies in the discharge estimated on this basis, some being in favor of a greater discharge and others against it. The figures are presented merely as approximate indications of the discharge in the New River below the mouth of the Greenbrier.

I presume the best disposition of the profile of the freshet of 1878 would be to file it as supplementary to the New River maps of the survey of 1874.

It may hereafter be convenient to refer to this flood of 1878 without referring to the maps or removing them from the files of the Engineer Department. For this reason I will transcribe a few of the notes marked on the profile.

GREENBRIER RIVER.

Graham's Ferry or Lowell Station.—High water September, 1878, 3.1 feet below top of piers at Railroad Bridge.

NEW RIVER.

Hinton.—High water, 1878, attained 21.1 feet reading on gauge, 0 of gauge being at the elevation 1,342.94 feet according to the levels of the New River survey of 1874.

Richmond Falls.—High water, 1878, attained the reading 12.5 feet on the gauge at head and 30.26 feet on the gauge below the foot of the falls. The 0 of the former is at the elevation 1,292.69 feet and of the latter at 1,260.98 feet referred to bench-marks of the survey of 1874.

Hawk's Nest.—High water, 1878, at 18.8 feet below × mark on coping of right abutment as shown by drift.

KANAWHA RIVER.

Kanawha Falls.—High water, 1878, attained a reading of 18.11 feet on the gauge at the head and 37.52 feet on gauge at the foot, the 0 of the former being at the elevation 638.0 feet and of the latter at 618.57, referring to the datum in use for the works on the Kanawha. It will be seen that the falls were "drowned out" at this stage of the river.

Loup Creek Bridge.—High water, 1878, four-tenths of a foot above rail and 3.38 feet above × mark on coping.

Armstrong's Creek Bridge.—High water, September, 1878, at 3 feet above rail and 3.38 feet above × mark on coping.

Morris Creek Bridge.—High water, September, 1878, at 1.92 feet above rail and 0.69 foot above × mark on coping.

Paint Creek Bridge.—High water, 1878, at 2.34 feet above rail and 2.66 above × mark on coping.

In this freshet of 1878 a quantity of logs were timed as they passed Quinnimont by a party about to take the train at that point and were again timed as they passed Hawk's Nest Bridge by the same party. It was found that the logs traversed this distance at the rate of about 8 miles per hour.

All of which is respectfully submitted.

THOMAS TURTLE,
First Lieut. of Engineers.

Maj. W. P. CRAIGHILL,
Corps of Engineers, U. S. A.

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H 24.

IMPROVEMENT OF GREAT KANAWHA RIVER, WEST VIRGINIA.

At the close of the year ending June 30, 1883, the work is in the following condition: Site 7 is in the possession of the United States; Lock 6 is nearly completed; the locks and dams at 5, 4, and 3 have been in use during the year; the possession of Site 2 has been lately acquired, and a contract made for a part of Lock 2, as much as allowed by the amount of available funds.

Having been ordered elsewhere on temporary duty, I was relieved of the charge of this improvement August 25, 1882, by Capt. E. H. Ruffner, Corps of Engineers, who continued the resident and supervising engineer until I resumed the charge, January 24, 1883, Captain Ruffner having about that time left the Kanawha Valley and been assigned to duty elsewhere. Lieutenant Townsend, Corps of Engineers, U. S. A., was the local engineer at Charleston from January 24, 1883, to February 7, 1883. Since February 7, 1883, Mr. A. M. Scott has been the local engineer in charge, having been previously the principal assistant engineer. The report of Mr. Scott, detailing the work of the year, is appended.

Money statement.

July 1, 1882, amount available		$135,209 96
Amount appropriated by act passed August 2, 1882		200,000 00
		335,209 96
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$107,479 91	
July 1, 1883, outstanding liabilities	17,203 55	
		124,683 46
July 1, 1883, amount available		210,526 50
Amount (estimated) required for completion of existing project		2,050,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		350,000 00

Abstract of proposals for building Lock No. 2, Great Kanawha River, West Virginia, opened at 12.05 o'clock p. m., January 31, 1883.

Subject of bid.	Approximate estimates.	No. 1.—D. M. Dull, and Geo. W. Keefer.		No. 2.—Lewis A. Danby and Charles Howind.		No. 3.—G. Harris and W. H. Black.		No. 4.—Frank Hefright.		No. 5.—Arthur T. McArthur.	
		Bid.	Amount.	Bid.	Amount.	Bid.	Amount.	Bid.	Amount.	Bid.	Amount.
	Cubic yds.	*Pr.cu.yd.*		*Pr.cu.yd.*		*Pr.cu.yd.*		*Pr.cu.yd.*		*Pr.cu.yd.*	
Grubbing and clearing	.....	.....	$1,000 00	.....	$100 00	.....	$1,000 00	.....	$100 00	.....	$100 00
Excavation	44,317	$0 90	39,885 30	$0 65	28,806 05	$0 90	39,885 30	$0 71	31,465 07	$0 40	17,726 80
Excavation (rock)	100	2 50	250 00	1 90	190 00	2 00	200 00	1 50	150 00	2 00	200 00
Embankment in place	13,465	50	6,732 50	25	3,366 25	60	8,079 00	25	3,366 25	30	4,039 50
Puddling	1,873	1 00	1,873 00	1 00	1,873 00	1 25	2,341 25	1 00	1,873 00	70	1,311 10
Pointed face masonry	2,519	11 00	27,709 00	15 00	37,785 00	14 50	36,525 50	10 00	25,190 00	9 50	23,930 50
Rock face masonry	5,075	10 50	53,287 50	11 50	58,362 50	12 00	60,900 00	10 00	50,750 00	8 00	40,600 00
Coping	423	17 00	7,191 00	22 00	9,306 00	30 00	12,690 00	10 00	4,230 00	18 00	7,614 00
Quoins	100	22 00	2,200 00	22 00	2,200 00	30 00	3,000 00	10 00	1,000 00	20 00	2,000 00
Sills	195	25 00	4,875 00	25 00	4,875 00	30 00	5,850 00	10 00	1,950 00	15 00	2,925 00
Backing masonry	9,632	9 00	86,688 00	5 00	48,160 00	7 00	67,424 00	10 00	96,320 00	7 00	67,424 00
Concrete	825	8 00	6,600 00	4 00	3,300 00	5 00	4,125 00	6 00	4,950 00	4 00	3,300 00
Paving	3,272	4 00	13,088 00	2 00	6,544 00	4 00	13,088 00	4 00	13,088 00	2 60	8,507 20
Riprap	327	1 50	490 50	1 50	490 50	2 00	654 00	1 50	490 50	2 00	654 00
Stone filling for cribs	3,576	2 00	7,152 00	1 50	5,364 00	2 50	8,940 00	1 50	5,364 00	1 50	5,364 00
Timber and plank in the permanent construction, per 1,000 feet B. M	289,494	40 00	11,597 76	45 00	13,027 23	50 00	14,474 70	35 00	10,132 29	35 00	10,132 29
Drift bolts, per pound	11,000	08	880 00	10	1,100 00	08	880 00	06	660 00	10	1,100 00
Bolt and dowel holes in masonry, per linear foot	.....	50	.....	14	.....	40	.....	15	.....	30	.....
Crib logs for coffer dam	38,900	20	7,780 00	25	9,725 00	25	9,725 00	40	15,560 00	25	9,725 00
Coffer-dam sheathing, per 1,000 feet B. M	16,560	30 00	496 80	40 00	662 40	40 00	662 40	20 00	331 20	50 00	828 00
			279,776 36		235,256 93		290,434 15		266,970 31		207,481 39

All rejected.

Abstract of proposals for building part of Lock No. 2, Great Kanawha River, West Virginia, opened at 12.05 p. m., May 15, 1883.

Subject of bid.	Approximate estimates.	No. 1.—Frank Hefright.		No. 2.—Daniel M. Dull.		No. 3.—H. D. Ruffner and James Grady.		No. 4.—James McArthur.		No. 5.—Charles Howind and Robert Lake.		No. 6.—George Harris and W. H. Black.		No. 7.—I. V. Hoag, jr., and L. M. Petitdidier.	
		Bid.	Amount.	Bid.	Amount.	Bid.	Amount.	Bid.	Amount.	Bid.	Amount.	Bid.	Amount.	Bid.	Amount.
	Cu. yds.	*Per cu. yd.*		*Per cu. yd.*		*Per cu. yd.*		*Per cu. yd.*		*Per cu. yd.*		*Per cu. yd.*		*Per cu. yd.*	
Grubbing and clearing complete	.....	.....	$100 00	.....	$1,500 00	.....	$300 00	.....	$20 00	.....	$500 00	.....	$500 00	.....	$300 00
Excavation	33.000	$0 55	18,150 00	$0 90	29,700 00	$1 00	33,000 00	$0 50	16,500 00	$0 70	23 100 00	$0 90	29,700 00	$1 25	41,250 00
Excavation (rock)	500	2 00	1,000 00	3 00	1,500 00	2 00	1,000 00	2 00	1,000 00	2 00	1,000 00	2 00	1,000 00	1 50	750 00
Embankment, in place	4,800	25	1,200 00	40	1,920 00	50	2,400 00	30	1,440 00	30	1,440 00	50	2,400 00	1 20	5,760 00
Puddling, in place	160	1 00	160 00	1 00	160 00	1 00	160 00	70	112 00	1 00	160 00	1 25	200 00	1 20	192 00
Cut stone masonry, in place	250	15 00	3,750 00	18 00	4,500 00	23 00	5,750 00	16 00	4,000 00	15 00	3,750 00	19 00	4,750 00	17 25	4,312 50
Pointed face masonry, in place	900	11 50	10,350 00	9 00	8,100 00	12 00	10,800 00	14 00	12,600 00	14 00	12,600 00	15 00	13,500 00	16 00	14,400 00
Rock face masonry, in place	1,670	10 00	16,700 00	8 00	13,360 00	11 00	18,370 00	10 00	16,700 00	12 00	20,040 00	12 00	20,040 00	15 25	25,467 50
Quoins, in place	37	20 00	740 00	25 00	925 00	23 00	851 00	20 00	740 00	22 00	814 00	25 00	925 00	26 50	980 50
Sills, in place	95	15 00	1,425 00	20 00	1 900 00	23 00	2,185 00	18 00	1,710 00	27 00	2,565 00	25 00	2,375 00	24 00	2,280 00
Backing masonry, in place	7,120	6 50	46,280 00	7 00	49,840 00	9 00	64,080 00	8 00	56,960 00	8 50	60,520 00	9 50	67,640 00	8 25	58,740 00
Concrete, in place	175	6 50	1,137 50	7 00	1,225 00	6 00	1,050 00	6 00	1,050 00	8 00	1,400 00	8 00	1,400 00	7 00	1,225 00
Riprap, in place	320	1 50	480 00	3 00	960 00	3 00	960 00	3 00	960 00	2 00	640 00	2 00	640 00	2 00	640 00
Timber and plank in permanent construction, per 1,000 feet B. M	17,000	35 00	595 00	40 00	680 00	45 00	765 00	50 00	850 00	50 00	850 00	50 00	850 00	60 00	1,020 00
Anchor bolts and their attachments, per pound	3,400	05	170 00	08	272 00	10	340 00	15	510 00	20	680 00	18	612 00	10	340 00
Crib logs for coffer dam, per linear foot	55,600	25	13,900 00	25	13,900 00	15	8,340 00	30	16,680 00	40	22,240 00	32	17,792 00	15	8,340 00
Coffer dam sheathing, per 1,000 feet B. M	29,000	20 00	580 00	36 00	1,044 00	25 00	725 00	60 00	1,740 00	40 00	1,160 00	35 00	1,015 00	35 00	1,015 00
Total of bids			116,717 50		131,486 00		151,076 00		133,572 00		153,459 00		165,339 00		167,012 50

Contract with Frank Hefright.

Abstract of proposals for building a frame lock-house at Lock No. 3, Great Kanawha River, West Virginia; opened at 12.15 o'clock p. m., June 27, 1883.

Subject of bid.	Approximate quantities.	No. 1.—John Morgan.		No. 2.—John Gilliland.		No. 3.—Henry Crawford.		No. 4.—James Henry Teubert & John Gresham.		No. 5.—David Eagan.	
		Bid.	Amount.	Bid.	Amount.	Bid.	Amount.	Bid.	Amount.	Bid.	Amount.
For house above foundation, including porches and outside steps, completed so far as asked for in specifications			$5,389 25		$4,210 00		$4,340 00		$4,204 55		$3,805 90
For items in foundation as follows:		*Per cu. yd.*		*Per cu. yd.*		*Per cu. yd.*		*Per cu. yd.*		*Per cu. yd.*	
For earth excavation..... cubic yards..	200	$0 25	50 00	$0 35	70 00	$0 30	60 00	$0 50	100 00	$0 30	60 00
For cellar-wall masonry, cubic yards in place	82	5 25	430 50	6 50	533 00	7 00	574 00	6 00	492 00	6 00	492 00
For brick masonry in cellars, bricks in place	3,000	*Per M.* 12 00	36 00	*Per M.* 15 00	45 00	*Per M.* 15 00	45 00	*Per M.* 13 00	39 00	*Per M.* 16 00	48 00
For pier stones with drafted corners	38	*Each.* 1 00	38 00	*Each.* 2 75	104 50	*Each.* 3 50	133 00	*Each.* 2 75	104 50	*Each.* 2 50	95 00
For pier stones, spalled sides	18	60	10 80	2 00	36 00	2 00	36 00	2 50	45 00	1 50	27 00
Total			5,954 55		4,998 50		5,188 00		4,985 05		4,527 90

Contract with David Eagan.

REPORTS OF MR. A. M. SCOTT, ASSISTANT ENGINEER.

1.

UNITED STATES ENGINEER OFFICE,
Charleston, Kanawha County, W. Va., July 7, 1883.

COLONEL: I have the honor to submit the following report on the improvement of the Great Kanawha River for the year ending June 30, 1883.

LOCK NO. 2 (FOR STATIONARY DAM).

[Below Cannelton 1 mile; above Charleston 26½ miles.]

The condemnation proceedings, referred to by Captain Ruffner in your last Annual Report, against the Cannelton Coal Company to secure the remainder of the land needed for lock site, were completed by the confirmation of the Kanawha circuit court, August 9, 1882. There was long delay, however, in the preparation and approval of the title papers. Payment was made by you for the land condemned and the piece bought of J. W. Dunn, constituting all acquired on lock side, in February. The Cannelton Coal Company was paid $1,400 for three and one-third acres, and Mr. Dunn $774 for three acres.

The papers for the land purchased by agreement on the abutment side were forwarded to the Department of Justice at Washington by the acting United States district attorney some time since, but for some reason have not yet been returned or reported on. On this side the Government is to pay E. G. Riggs $1,250 for four and four-fifths acres, and J. P. Brinton $200 for about two acres. Cost of site, not including condemnation expenses, $3,624.*

Contract for lock.—After regular advertisement (by Captain Ruffner, dated December 10, 1882), bids were opened under your direction for the construction of the lock January 31, 1883. It was decided to reject all of those bids, and by advertisement dated April 23 you invited proposals for building *part of the lock* on considerably modified plans. The lowest bidder was Mr. Frank Hefright, to whom the work was awarded by contract signed June 5, 1883.

This lock, like No. 3 below it, is for a stationary dam. The maximum lift will be 12 feet, extending the navigation back 6 miles to the foot of Loup Creek Shoal.

The lock will be 308 feet long between quoins and 50 feet wide at level of miter-sills. The walls are to be built on the solid rock, which is here found from 12 to 14 feet below low-water surface of No. 3 pool. The funds available were insufficient to build the whole lock. Under the present contract the masonry of the lock (except a part of the upper wing), including miter and cross sills, breast-walls, culverts, &c., will be completed to level of top of upper miter-sill, being from 16 to 18 feet above rock foundation, and within about 20 feet of final top of coping. In addition, the land wall and lower wing will be carried up two courses (3 feet and 8 inches) above level of upper miter, and the embankment between wall and bank made to that height. The amount of *masonry* embraced in the present contract is about 10,500 cubic yards; earth work, not including coffer-dam, about 38,000 yards.

The contractor arrived June 15, and on the 18th began work with a small force, grubbing and clearing the bank and in opening a quarry about one-half mile below the site. He has agreed with Bradford and Smith, the parties that recently bought the old Kanawha Board dredges, to do the dredging, and one machine began excavating for the coffer-dam July 3. The second dredge will be got to work soon. Arrangements for the immediate delivery of some of the coffer logs and sheathing has also been made.

Mr. T. Schoonmaker, assistant engineer, who has been employed since March on office work and surveys in connection with Lock 2, has local charge there of construction.

Assistant Engineer Geo. B. Whitney has been in the employ since February, principally on office work, and has also been mainly engaged on maps and plans for Lock 2.

Lock house.—Plans and specifications for a house and office combined have recently been made and bids for furnishing the material and building it were opened June 27. The lowest bidder was David Eagan, of Charleston, to whom you have recommended the awarding of the contract.† It will be a double house, similar to that at Lock 6. But one part of it, including the office, will be finished off under this contract, for use of the Government during the construction of the lock and dam.

LOCK NO. 3 (PAINT CREEK). (STATIONARY DAM.)

[21 miles above Charleston.]

As shown in the last Annual Report, this lock and dam were practically completed a year ago. The remainder of the sheathing of the dam was placed in August. The

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*These payments have been since made.—W. P. C.
†The contract has been awarded to Mr. E.—W. P. C.

dam has never been "banked," however, as was originally intended, and during the low water last fall the leakage through the cribs reduced the water in the pool over 3 feet below the top of the dam. Some of the coal men in the pool got Captain Ruffner's consent to tighten the dam with straw and brush. The pool remained full during the rest of the season, after this was done, but it is probable that low stages this summer and fall will show the necessity of banking the dam, as originally proposed, with dredged material.

Referring to the "disturbance at the foot of the lock by waves resulting from the overfall of the dam" at high stages, alluded to in the report of the Board of Engineers, dated June 21, 1882 (see Report of the Chief of Engineers, 1882, page 928), the natural scouring away of the high bank of dredged material left below the dam, the partial removal of the old coffer, together with the dredging done last season at the lower approach, have practically removed all serious troubles from this source.

During the last winter boats have passed without difficulty at all stages when the lock could be worked, and on one occasion loaded coal-boats were locked down with the water within one inch of the top of the lower gates. The removal of the rest of the old coffer-dam and some further dredging, proposed, below the lock, will tend to reduce still more the disturbance at the approach.

The scour of the bank on the abutment side was increased somewhat by last winter's floods, but the bank is practically in the same condition it was a year ago, when reported on by the Board.

As a protection to our works some riprap (about 800 cubic yards in all) has recently been placed below the paving on the abutment side, and below the lower crib on lock side.

The following is a summary of records kept at the lock for the year ending June 30:

Number of steamers locked	1,444
Number of coal barges and other craft	327
Number of passengers	8,050
Number of tons, miscellaneous freight	2,011
Number of feet of lumber (board measure)	410,206
Number of bushels of coal	1,161,700
Total number of lockages	1,333

LOCK NO. 4. MOVABLE (CHANOINE) DAM.

[16 miles above Charleston.]

The dam has been entirely up one hundred and forty-three days during the year. It was down at the beginning of the year (July 1), having been thrown June 29. It was put up July 10 in ten hours and fifteen minutes. Some delay was occasioned by a large rock found wedged under the tripping bar.

It was thrown again July 13. Time required, two hours; everything working right. Began to raise July 19, 9.30 a. m.; finished on 22, 5.15 p. m. Delay caused by lock section of tripping bar being off the guides and a broken bed-plate in the gearing wells. Dam thrown again for a rise August 20, at 7.30 p. m.; all down at 10.30 p. m. Began to rise August 14; finished 3 p. m. of 15th, delay caused by broken pinion in lock-gearing wells. Dam lowered for a rise September 1, all down in one hour and forty-five minutes. Put up on 7th. Time required, seven hours and thirty minutes.

Dam lowered for a rise September 11, 12.30 p. m.; finished 3.50 p. m. Three pass-wickets failed to trip and were hooked down from below. Dam raised September 25 and 26. Time taken, nine and one-fourth.

Dam lowered for the winter (a good deal of ice moving) December 8 and 9; finished 5.10 p. m. The pier tripping-bar refused to work, and the twenty-eight wickets were lowered with winch and hook.

May 7, began to raise the dam. All up on the 21st. The pinions in both gearing wells were found broken. The repair necessitated the removal and replacement of the shafts, bottom rollers, guides, &c., a troublesome and disagreeable job. The whole force and an extra man were at work the most of the time from the 9th to the 20th in cleaning out the gearing wells, replacing the shafts and pinions, in short, in getting the tripping bars in working order.

The dam was lowered June 12 and 13, and raised again on the 18th. In lowering, three pass-wickets failed to trip, and were hooked down. The lowering of the bridge was much delayed by green brush and trees that had been cut and thrown in the river above.

In raising, five and one-half hours were taken to get the pier tripper into gear, it having been pushed out too far after lowering.

SUMMARY OF RECORD KEPT AT NO. 4 FOR THE YEAR.

Number of steamers locked during the year		860
Number of coal barges and other craft		392
Total number of lockages, all kinds		855
Coal down through the Navigation Pass	bushels	3,684,500
Coal down through the lock	do	1,180,100
Steamers through the Navigation Pass		1,423
Coal barges and other craft through the Navigation Pass		799
Rainfall during the year	inches	39.93

LOCK NO. 5. MOVABLE (CHANOINE) DAM.

[9 miles above Charleston.]

The dam has been up one hundred and eleven days during the year.

The placing of the Pasquean hurters on the lock section was completed August 12, and the dam was entirely up on the 15th. It remained up, with the exception of a partial experimental lowering made on the 18th, until August 31, when it was thrown for a rise. In lowering, on the 31st, the tripping bar on the pier section refused to work, and the Pasquean section was thrown first—the thirty-four wickets being lowered in one hour and thirty-five minutes (they have since been thrown, as reported below, in considerably less time). After this the twenty-eight pier section-wickets were lowered by winch and hook pulling ahead at top from bridge and tripping from boat below; whole time taken in lowering, three hours and fifty-five minutes.

The dam remained down until September 7, when the raising begun at 10 a. m. All up at 8 a. m. of 9th. Some time lost by breaking of trestle chains.

The dam was next lowered (but partially, however, as reported below) on the 11th of September for an extraordinarily rapid local rise, due to a heavy rainfall on the preceding day and night. The following in reference to it is an extract from my monthly report to Captain Ruffner:

"The water was rising rapidly at No. 5 early on the morning of the 11th, and everything was ready to begin lowering at 7 a. m. The order to begin was given by telephone at 9.40 a. m., and the lowering commenced at once on the lock (Pasquean) section. These thirty-four wickets were thrown without any trouble in one hour and twenty minutes. The water was rising so fast that with the thirty-four wickets down it was nearly up to the top of those standing, and the "back lash" and "roll" below the dam were so bad that it was impracticable to *pull* the pier wickets down (the tripping bar was out of order). The same was true of the wickets of the weir (they were all on the swing), and it was decided to lower the bridges and leave the twenty-eighth pass and all the weir wickets up. The bridges went down all right and were out of the way at 1.30 p. m. The water reached its height (about 19½ feet above low water at lock) on the 13th, and fell so that the twenty-eight pass wickets were lowered on the 16th. *No damage was done to either of the pass or weir wickets by the rise.*"

It will be noticed that over two and one-half hours elapsed after everything was ready to lower before the first wicket was thrown. Mr. Davenport, the lock-keeper, wanted to begin at 7 a. m., but the order was withheld, as stated, until 9.40. This is referred to to show, in connection with the almost unprecedentedly rapid local rise, the unusually unfavorable conditions connected with this lowering. As stated, the thirty-four Pasquean arranged wickets were thrown from the bridge in eighty minutes. (They have since been thrown in less time. In November, twenty-three of them were lowered, after the head had run down to about 2 feet, however, in twenty minutes.)

The last of the thirty-four wickets was lowered about 11 a. m., and at 1.30 p. m. the bridges (pass and weir) were out of the way. At this time (1.30) the upper gauge showed the water only six-tenths above the normal level of the pool, or 2 feet below bridge reference. *It is apparent that even under these extraordinary circumstances, with Pasquean hurters throughout, on both pass and weir, the whole dam could have been safely lowered after* 9.40, *with time to spare.*

The other movements of the dam during the year are not of sufficient interest to justify recital. The year's experience has demonstrated the successful working of the Pasquean hurters and their decided superiority, particularly as applied to this river, over the tripping bars. In fact, the advisability of avoiding the tripping bars in future construction and of getting rid of those already in use as soon as practicable, is considered well established.

Lowering from a boat.—During last fall several experimental trials were made at lowering the pass (Pasquean arranged) wickets from a boat, anchored above, looking to the omission, if possible, of the pass bridge in future Chanoine dams. The regular service boat (60 by 16 feet) was suspended above the dam, the lower end being kept about 20 feet from the line of wickets, by two lines, one anchored in line of the pier

and about 300 feet above; the other attached to the crib at the head of the lock. The maneuvering crab set at the lower end of the boat, and the lowering was done by pulling ahead at the top of the wickets by means of the wicket clutch, as from the bridge. At the last trial the clutch was placed from a plank that projected 22 feet below the boat, the plank being supported by an "A" brace. The lowering began near the middle of the dam, and the boat worked over, by hand, by side lines, as the wickets went down. The best average time made in lowering was three and one-fourth minutes to the wicket. At least half this time was taken in working the boat over and in handling the side lines. Our experience indicates that with a properly rigged boat having steam capstans to maneuver wickets and lines, two minutes to the wicket would be time enough, under ordinary circumstances, to allow for lowering *after the boat was in position*, and it is probable that practice would reduce it to less.

Altogether the experience thus far in this, though not at all decisive, is thought to be against the advisability of dispensing with the service bridge. Considering the time required to lower the bridge itself, it is probable that under favorable circumstances, with a properly fitted and managed boat, the entire lowering could be accomplished about as quickly without it. In case of wind or ice, however, particularly if at night, the objections to the boat might be serious. Under such conditions the *dangers* would certainly be much greater with the boat than from the bridge. The possibility, too, of the boat being carried over the dam by the breaking or misplacing of lines cannot, perhaps, be entirely overcome.

In conclusion, while it is not improbable that future practice here and on the Ohio (Colonel Merrill, it is understood, is to try the experiment at Davis Island Dam) will demonstrate the practicability of maneuvering Chanoine pass wickets with a boat. Our present experience teaches that it is not advisable to build a dam of this kind without providing the foundations and fastenings for the trestles of the bridge.

The following is from Lock 5 records:

Number of steamers locked during the year		944
Number of coal barges and other craft locked during the year		425
Coal down through the lock	bushels..	1,401,100
Coal down through the Navigation Pass	do....	4,755,103
Steamers through the Navigation Pass		1,847
Coal-barges and other craft through the Navigation Pass		1,243
Total number of lockages		871
Rainfall during the year	inches..	39.58

LOCK NO. 6 (FOR MOVABLE DAM).

[4 miles below Charleston and 54 above the mouth of the river.]

This lock, practically begun by Contractors Harris & Black in the spring of 1881 (the contract was signed November 4, 1880, and some *preliminary* work was done that winter), is nearly finished.

Of masonry proper there yet remains nearly five full courses, including coping, or about 925 cubic yards to lay all on the river wall. The land wall is finished. Both land cribs are in, filled and paved; and the embankment, back of land wall and cribs, up to height.

The upper river crib is about two-thirds built and filled. The paving of the embankment back of land wall has been placed for 140 feet down from upper wing and the spall covering is on, ready for the paving, 140 feet farther down. The grading of the bank immediately back of lock is nearly finished ready for the riprap and spalls, and something has been done toward grading above and below the lock. The old coffer-dam has been about half removed. At present rate of progress, from three to four months will be required to complete the work under the contract. A considerable part of the face-stone and coping required to finish the river wall is yet to be cut.

Character of foundations.—At the close of the last fiscal year none of the foundation of the lower end of the lock, embracing both tail walls, lower miter and cross sills, had been placed. The soft rock unexpectedly met with at this part of the lock, referred to in the last Annual Report, extended much deeper than was expected. At one point under land tail wall the excavation reached 13 feet below the top of sill, or 18.3 feet below "low-water" reference, before acceptable foundation was reached. This is about 7½ feet below the average foundation of the greater part of the lock. Under the river tail wall the soft rock was found still deeper, and at a point 90 feet above, lower end, the foundation is 16½ feet below sill, or 21.8 feet below low-water reference. The average depth of foundation of lower miter is 11 feet below sill, and the sill anchor bolts (wedge bolts of 1¼-inch iron extending into solid rock) have an average length of 14 feet. The rock removed was a soft, clean sandstone, mostly taken out with pick and shovel. Under the land tail wall the hole or ditch caused

by the excavation was filled to about the average level of foundation with concrete; but under miter sill and river tail wall, rock face and rough rubble were used from the bottom. At the lower end of the lock the solid rock came up again nearly to the average height of foundation, *i. e.*, from 11 to 12 feet below low water. The soft patch extended across the lock, tending up-stream as we went out, and at the edge of the river wall would nearly miss the foundations of the Navigation Pass. It is hoped that little, if any, of this defective rock will be met with within the limits of the dam. Borings will be made, during low water this fall, on lines of the dam to ascertain more definitely the character of the foundations.

Mr. E. H. Kirlin has, with his well-known efficiency, continued to act as inspector at Lock 6 during the year.

Thomas E. Jeffries, assistant engineer, has been employed in giving lines, making measurements, estimates, &c., and in general office work, mostly connected with Lock 6. His duties have been faithfully and well performed.

DREDGING.

The dredge, assisted by the steamer Bee to tow the dump boats, &c., has been kept employed, when circumstances would permit, in deepening and widening the channel, principally at the high points in Nos. 4 and 5 pools. Last summer and fall operations were mainly confined to improving the lower approach at Lock 3, and in removing a part of the old lock coffer there, and in work at head of Witcher's Creek Shoal. The dredge was laid up for the winter, December 5. Just before this a small job was done at Harvey's Shoal at head of Pool 3. The work last season at Witcher's Creek made about 5 feet available towing water with the dam up. This is the only point of any importance in Pool 5 where we have less than the proposed 7 feet depth. In Pool 4 there are three high points: Cabin Creek, Bouseman's, and No. 3 Approach. It is the purpose this season, if possible, to make good 6 feet towing depth, all that the present business requires at all of these points. At Witcher's a large area must be gone over to make the additional foot, and will require considerable time. Operations thus far this season, with the exception of a few days at Bouseman's, have been confined to Cabin Creek Shoal, where the work is now going on.

The character of this part of the river and its bed are such, the latter being generally composed of coarse gravel and bowlders, usually with *some* sand and mud, that the dredged channels are considered permanent.

Very respectfully, your obedient servant,

A. M. SCOTT,
Assistant Engineer.

Lieut. Col. WILLIAM P. CRAIGHILL,
Corps of Engineers, U. S. A.

2.

CHARLESTON, KANAWHA COUNTY, W. VA.,
August 18, 1883.

COLONEL: The reductions of a set of observations for discharge of the Great Kanawha River, made at Elk Shoal (in the chute), at the lowest point of the remarkably low stage of 1881, are given below. The observations were made September 15, with Charleston gauge reading one-tenth of a foot below zero of gauge. This was 1.6 feet below our ordinary low-water (1872) reference, and 1.1 feet lower than previously shown by our gauge record, which begins July 1, 1873.

The surface of No. 5 pool was kept stationary during the day the observations were taken, and the water had been on a stand at Charleston for two days before.

WITH DOUBLE MID-DEPTH FLOATS, BASE 200 FEET.

Upper end area, 479 square feet. Upper end discharge, 1,107. Lower end area, 496.5 square feet. Lower end discharge, 1,153. Average, 1,130 cubic feet per second.

SURFACE FLOATS.

Area, 486.2 square feet; unreduced discharge, 1,315—10 per cent., equal to 1,183.5 cubic feet per second. This was generally considered by river men "the lowest water since 1838." In this connection the following is of interest:

On the 26th of August, 1881, Mr. Philip Doddridge, a well-known Kanawha pilot, left Charleston in a skiff to examine the river. On the 27th, at the foot of Knob Shoal, on a solid rock ledge, he found a distinctly-cut mark, lettered "September 21, 1838, Sam Burk." On that day, August 27, 1881, there were 1¼ inches of water on

Burk's mark. Charleston gauge showed that day + 0.17 foot, or 0.27 foot higher than when the above discharge observations were taken, the lowest point of 1881.

The following is an extract from Ellet's report (1858) on the improvement of the Great Kanawha:

"Subsequently, however, the water fell that year to a lower point than it had ever before been seen, and lower than it has ever since been. Mr. Gill, during this extremely low water, reported his measurements below Buffalo, and reported the result to be 1,100 cubic feet per second."

Very respectfully, your obedient servant,

A. M. SCOTT,
Assistant Engineer.

Lieut. Col. WILLIAM P. CRAIGHILL,
Corps of Engineers. U. S. A.

COMMERCIAL STATISTICS.

UNITED STATES ENGINEER OFFICE,
Charleston, Kanawha County, W. Va., July 10, 1883.

COLONEL: In compliance with instructions relative to the collection of commercial statistics for your annual report, a circular letter was addressed to the different coal operators along the Great Kanawha River, asking for a statement of shipments for year ending May 31, 1883. A summary of the information thus collected is submitted herewith. For comparison, a statement of shipments made during the year ending June 30, 1881, is also given. It will be noticed that the production within two years has increased from about 16,250,000 to over 28,500,000 bushels. The shipments by river from 9,628,696 to 15,370,458. The number of operators has doubled within the time. Referring to the comparative shipments by rail and river, it appears that twelve operators ship only by rail. It is important to call attention to the fact that all twelve of these mines are above present slackwater, and that all of them will be reached by No. 2 pool. Several of these parties are already getting ready, building tipples, &c., to ship by river as soon as Lock and Dam 2 are finished.

Very respectfully, your obedient servant,

A. M. SCOTT,
Assistant Engineer.

Lieut. Col. WILLIAM P. CRAIGHILL,
Corps of Engineers, U. S. A.

Statement showing shipments of coal from the mines on the Great Kanawha River, West Virginia.

No.	Names of operators.	Shipments for year ending May 31, 1883.			Shipments for year ending June 30, 1881.		
		By rail.	By river.	Total.	By rail.	By river.	Total.
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
1	Winifrede Coal Company	199, 868	1, 325, 791	1, 525, 659	.....	.....	.....
2	Robinson Coal Company	631, 107	917, 300	1, 548, 407	1, 643, 824	70, 112	1, 713, 936
3	Crown Hill Splint Coal Company	610, 260	272, 604	882, 864	.....	.....	.....
4	Dana Brothers	.....	1, 899, 789	1, 899, 789	.....	760, 144	760, 144
5	Mount Morris Coal Company	700, 000	.....	700, 000	481, 320	23, 800	505, 120
6	Eagle Coal and Coke Works	1, 497, 810	.....	1, 497, 810	.....	.....	.....
7	Coal Valley Coal Company	1, 015, 960	.....	1, 015, 960	948, 192	.....	948, 192
8	The Saint Clair Company	190, 000	.....	190, 000	.....	.....	.....
9	Bennington Colliery	.....	394, 000	394, 000	.....	530, 684	530, 684
10	Campbell's Creek Coal Company	.....	3, 070, 463	3, 070, 463	.....	2, 409, 260	2, 409, 260
11	Kanawha Mining Company	613, 933	337, 296	951, 229	.....	.....	.....
12	Cedar Grove Coal Company	.....	520, 000	520, 000	.....	.....	.....
13	Peabody Coal Company	.....	1, 012, 234	1, 012, 234	.....	311, 024	311, 024
14	Crescent Coal Mines	2, 016, 000	.....	2, 016, 000	.....	.....	.....
15	M. T. Davis & Co	1, 102, 892	.....	1, 102, 892	.....	.....	.....
16	Kanawha Cannel Coal Company	50, 000	608, 000	658, 000	.....	.....	.....
17	F. Faulkner	775, 202	8, 355	783, 557	.....	.....	.....
18	Cannelton Coal Company	1, 068, 045	.....	1, 068, 045	840, 000	.....	840, 000
19	Henson & Talley	239, 629	.....	239, 629	.....	.....	.....
20	Marmet Mining Company	.....	1, 601, 188	1, 601, 188	.....	*2, 409, 260	2, 409, 260

*Estimated.

Statement showing the shipments of coal from the mines, &c.—Coatinued.

No.	Names of operators.	Shipments for year ending May 31, 1883.			Shipments for year ending June 30, 1881.		
		By rail.	By river.	Total.	By rail.	By river.	Total.
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
21	Pioneer Coal Company	.....	1, 848, 715	1, 848, 715	.....	*2, 409, 260	2, 409, 260
22	Wyoming Manufacturing Company	242, 564	.....	242, 564	.....	.....	.....
23	Geo. Straughan (Coal Valley)	762, 227	.....	762, 227	918, 316	90, 356	1, 008, 672
24	Geo. Straughan (North Coalburg)	.....	980, 000	980, 000	.....	.....	.....
25	Logan Coal and Salt Company	.....	*400, 000	400, 000	.....	.....	.....
26	Carver Brothers	1, 313, 340	.....	1, 313, 340	783, 188	266, 000	1, 049, 188
27	Other parties	261, 418	174, 723	436, 141	1, 016, 820	348, 796	1, 365, 616
		13, 290, 255	15, 370, 458	28, 660, 713	6, 631, 660	9, 628, 696	16, 260, 356

*Estimated.

H 25.

IMPROVEMENT OF ELK RIVER, WEST VIRGINIA.

There was an appropriation of $2,000 August 2, 1882, as well as a balance, smaller in amount, remaining from previous appropriations, but nothing was done on this river in the year ending June 30, 1883, the Secretary of War having directed, in accordance with the recommendation of the superintending engineer, approved by the Chief of Engineers, that all operations be suspended until the obstruction to navigation caused by the remains of the old lock and dam near its mouth be remedied. This lock and dam were built under the authority of the State of West Virginia.

Money statement.

July 1, 1882, amount available		$973 90
Amount appropriated by act passed August 2, 1882		2, 000 00
	2, 973 90	
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	10 00	
July 1, 1883, amount available		2, 963 90

LETTER OF MR. A. M. SCOTT, ASSISTANT ENGINEER, TO THE HON. JOHN E. KENNA.

UNITED STATES ENGINEER OFFICE,
Charleston, Kanawha County, W. Va., July 2, 1883.

DEAR SIR: I have now to submit to Colonel Craighill the annual report on the "Improvement of Elk River." You are informed that expenditures on this work have been withheld by the Department during the last year on account of the condition of the old lock and dam and complications connected with the charter of the company owning it. I will thank you to inform me whether any legal steps have been taken to remove the obstructions, and for any suggestions in reference to the river that you may be pleased to give.

Yours, very respectfully,

A. M. SCOTT,
Assistant Engineer.

Hon. JOHN E. KENNA,
Charleston, W. Va.

LETTER OF HON. JOHN E. KENNA TO MR. A. M. SCOTT, ASSISTANT ENGINEER.

CHARLESTON, W. VA., *July* 6, 1883.

DEAR SIR: I have your letter of the 2d instant asking for information concerning the obstruction to the navigation of Elk River, growing out of the old lock and dam therein, and especially with reference to the legal status of the controversy affecting its removal. You are aware that a sluice-way or gap has been cut through the dam for the purpose of allowing of the passage of rafts and other craft, and doubtless concur in my own opinion that the obstruction is not yet satisfactorily out of the way. I have to inform you, in this connection, that a recent grand jury of the county preferred indictments against the parties owning the lock and dam and against the parties owning the boom near it. I am informed by Mr. Wm. E. Chilton, the prosecuting attorney for Kanawha County, that he deems it his duty, in the public interest, to press both these prosecutions to as early a conclusion as practicable. Of the successful result of the undertaking neither he nor I have any doubt. Indeed, in one instance the parties interested have given assurance of their purpose to complete the removal of the obstruction before the sitting of the ensuing court. I have reason to believe that in the other—namely, the matter of the dam—a similar course will be pursued. The removal of these so-called improvements and the obstructions incident thereto will operate, under the respective charters, as a practical abandonment of such claim as has given rise to the difficulties heretofore existing and probably leave the river, in the greatest part, open and unembarrassed.

I desire to add that a natural obstruction, consisting of three or four large rocks, at what is known as the "Gulf," on the upper river, has greatly interfered with the shipments from the splendid lumber region lying above it, and from personal observation I am satisfied that a small amount to be expended chiefly in blasting will remove it. I do not think $500 will be required for this purpose. I could scarcely give a better illustration of the value of this particular work than by a reference to very similar aid to the Guyandotte, and its result. On that river, before work was commenced by the United States, a serious average loss to its lumber interests, amounting to 10, 15, or even 20 per cent., was suffered. Since the expenditure of about $4,000 on the river I am informed reliably that lumber to the value of $50,000 was, the last spring, shipped by one firm something near 100 miles without the loss of a single log.

The "Gulf" in Elk River is 120 miles or more from the mouth of the river. The obstruction at that point cuts off from outlet one of the finest and most valuable timber regions of the State. In view of this fact and of the small amount necessary to its removal, I strongly recommend that a part of the fund in hand for improvement of the Elk be devoted at as early a day as practicable to this important work at the "Gulf."

Very respectfully,

JNO. E. KENNA.

Mr. A. M. SCOTT,
Assistant Engineer.

H 26.

IMPROVEMENT OF CAPE FEAR RIVER, NORTH CAROLINA.

The principal work of the year has been the dredging in the new channel along and above Snow's Marsh. The progress of the work has not been altogether satisfactory. The reasons for the delay are given in the appended report of Mr. Henry Bacon, who has continued in the local supervision of the improvement. Other matters are also treated by him in detail.

Although the suction-dredge Woodbury was withdrawn from work in the Baldhead Channel early in October, 1881, the depth of 14 feet at mean low water has been maintained. It was desired to see what would be the effect of this suspension of dredging in that channel. It is very probable a continuance of her work would have increased the depth, but this has not seemed necessary when the depth over the Baldhead Bar was considerably greater than that from Smithville to Wilmington. The indications of a successful conclusion of this improvement continue to be very good.

Money statement.

July 1, 1882, amount available		$63,030 74
Amount appropriated by act passed August 2, 1882		225,000 00
		288,030 74
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$108,746 92	
July 1, 1883, outstanding liabilities	10,891 30	
		119,638 22
July 1, 1883, amount available		168,392 52
Amount (estimated) required for completion of existing project		482,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		300,000 00

Abstract of proposals for dredging in Cape Fear River, North Carolina, opened at 12.05 p. m., September 28, 1882.

No.	Names and addresses of bidders.	Date of commencement.	Date of completion.	Price.	Remarks.
				Per cu. yd.	
1	R. Moore, Mobile, Ala	90 days.		$0 17 3/10	Will do not less than 50,000 yards per month.
2	National Dredging Company, Wilmington, Del.	Jan. 10, 1883	June 30, 1883	16 7/10	
3	New York Steam Dredging Company, New York city.	Jan. 1, 1883	Nov. 1, 1883	17¾	Will do not less than 50,000 yards per month.
4	George C. Fobes & Co., Baltimore, Md.	Jan. 1, 1883		18	Average about 30,000 yards per month.

Contract with National Dredging Company.

Abstract of proposals for dredging in Cape Fear River, North Carolina, opened at 12.05 p. m., June 26, 1883.

No.	Names and addresses of bidders.	Date of commencement.	Date of completion.	Price.
				Per cu. yd.
1	W. C. Turner, Philadelphia, Pa	Oct. 1, 1883	Soon as possible.	$0 19½
2	D. Constantine, Baltimore, Md	Jan. 1, 1884	July 1, 1884	16½
3	F. B. Colton, Wilmington, Del	Oct. 15, 1883	Mch. 1, 1884	18
4	New York Steam Dredging Company, New York, N. Y.	July 10, 1883	Dec. 31, 1883	14½
5	Geo. C. Fobes & Co., Baltimore, Md	Oct. 15, 1883	June 30, 1884	14½
6	A. R. Wright, Geneva, N. Y		June 30, 1884	19

Contract with New York Steam Dredging Company.

REPORT OF MR. HENRY BACON, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., July 9, 1883.

COLONEL: I have the honor to submit the following report of operations for the improvement of Cape Fear River below Wilmington during the year ending June 30, 1883:

The principal work has been the dredging of the new channel along and above Snow's Marsh from the deep water of the harbor of Smithville to deep water in the old channel about 1½ miles above Federal Point. The position of the new cut and its connection with the old channel leading around the Horseshoe is shown by the annexed sketch, from which it may also appear that the new work is a restoration of a former natural channel. After nearly two years' work on the cut it is now nearly finished to 270 feet width and 16 feet depth at mean low water. It is about 2½ miles in length. The distance saved exceeds one-half a mile, but this distance is of trifling importance in comparison with the avoidance of old Horseshoe Channel, where the tidal currents are at times nearly at right angles to the direction and never coincident

with it, which made it difficult for navigation, and variable in position and depth, and always shoal. The tidal currents through nearly the whole length of the new channel are exactly coincident with its direction, and there is but a small deflection at any point, and this deflection has been less as the work has progressed. It is apparent, from the shape of the great tidal basin both above and below Federal Point and Snow's Marsh, as seen in the sketch, that there must be a division of the tidal currents, one passing around the shoals by Federal Point, and the other taking the straight course of the new channel past Snow's Marsh. The latter, being the shortest line and the deepest water, takes the main ebb and flood currents, and with greatest velocity.

At the point where the deflection exists, which is on the middle portion of the upper reach (above Snow's Marsh,) a slight shoaling of the dredged channel has occurred. This is in soft mud, and proceeds from the small side channel of the western shore of the river, which extends in depths of from 10 to 12 feet for nearly 2 miles up the western shore. A portion of this flow will be cut off some 2 to 3 miles above by dumping the dredged materials of the next cut above at the western shore, thus having the effect of a jetty to keep the main currents in the main channel, and being so remote from the channel as to avoid any danger of the materials being carried into it. It is possible that it may at a future time be expedient, in order to avoid frequent repairs of the dredged channel, to build a submerged stone jetty along the low tongue of shoals which divides the main channel from the new cut, parallel to the new channel. It should be about 1,800 feet in length and have an average height of 6 feet. It would cross the former outlet of the side channel, before referred to, and deflect the ebb-tide into the new channel and the flood into the old one. About 8,000 cubic yards of small stone riprap would be required, and would cost about $2 per yard, or $16,000. The construction of such a work is not recommended at present, but the conditions should be carefully observed and reported on at a future time.

The work of opening Snow's Marsh Channel was begun in 1874. It was cut to 100 feet width and 9 feet depth at mean low water in 1874 and 1875, and enlarged and deepened to 190 feet width and 12 feet depth in 1875 and 1876. The channel maintained itself as dredged, excepting for a short distance above the head of Snow's Marsh, where it was crossed by the main currents of the river at a considerable angle. On this portion it quickly shoaled to its original depth. In re-opening, enlarging, and deepening the cut it was found necessary to change its direction above the head of Snow's Marsh so as to bring it approximately into the axis of the currents, as before mentioned. The first contract for the last enlargement was made with Mr. G. H. Ferris, from proposals opened May 26, 1881. Only 303,535 cubic yards of dredging was done during the contract time, which expired June 30, 1882. Two extensions of time have been granted, bringing it to June 30, 1883, when the contract was completed.

Proposals were invited for continuing the work of dredging, and opened September 28, 1882. The contract for about 450,000 cubic yards was awarded to the National Dredging Company, the lowest bidder, at 16.7 cents per cubic yard, and the time fixed was June 30, 1883. At the end of the contract time only 116,678 cubic yards of dredging had been done, and the contract was annulled. Proposals were invited to be opened June 26, 1883, for dredging about 300,000 cubic yards to complete the channel across the next shoal above the Snow's Marsh Channel. The lowest bid was 14½ cents per cubic yard, to finish June 30, 1884. The next, from the New York Steam Dredging Company, was 14⅞ cents per cubic yard, to finish December 31, 1883. The latter was considered as the best proposition on account of the additional expenses to be incurred during the longer time and the advantages to commerce in having the work done six months earlier. The amount of materials removed during the year and dumped in the deep water adjacent to the New Inlet Dam are as follows, in cubic yards:

1882.	G. H. Ferris.	National Dredging Company.
July	40, 968	
August	37, 756	
September	58, 371	
October	51, 007	
November	39, 981	
December	16, 616	18, 003
1883.		
January	11, 281	30, 370
February	15, 398	47, 219
March	39, 153	21, 086
April	45, 530	
May	72, 600	
June	47, 787	
	476, 448	116, 678

The series of projects, some of which are now being executed, began with the appropriation of 1870. The following appropriations have been made by Congress:
By act approved—

July 11, 1870	$100,000
March 3, 1871	75,000
June 10, 1872	100,000
March 3, 1873	100,000
June 23, 1874	150,000
March 3, 1875	150,000
August 14, 1876	132,500
June 18, 1878	160,000
March 3, 1879	100,000
June 14, 1880	70,000
March 3, 1881	140,000
August 2, 1882	225,000
Total	1,502,500

The present project embraces the completion of a dredged channel from the deep water of the harbor of Smithville to Wilmington of 270 feet width and 16 feet depth at mean low water at all places where dredging is required to attain that depth and width; the construction of a line of defense against the swashes, of mattresses and stone, from Zeke's Island to the big marsh; and the operation of the suction dredge Woodbury to preserve, maintain, and keep in proper position the Baldhead Channel at the mouth of the river.

The following is the estimate of the amount required to complete the present project:

300,000 cubic yards of dredging under the contract of the New York Steam Dredging Company, at 14⅞ cents	$44,625	00
1,321,000 cubic yards of dredging, at 28 cents	369,880	00
Defense against swashes, as before stated	159,550	00
Repairs of suction dredge Woodbury	1,500	00
Operations of Woodbury, fifteen months, at $1,000	15,000	00
Add 10 per cent. for contingencies and superintendence	59,055	50
	649,610	50

The increase of price of dredging from 25 to 28 cents on the remaining work is on account of the greater difficulty of some of it in comparison with the 300,000 yards contracted for at 14⅞ cents. The average of the whole is but little over 25 cents per cubic yard.

Mr. A. H. Van Bokkelen, president of the Chamber of Commerce of Wilmington, is preparing with much care a statement of the commercial statistics of the port, which he will forward directly to you.

From the letter of Mr. E. I. Pennypacker, collector of the port of Wilmington, which is forwarded herewith, it appears that the amount of revenue collected from customs for the year ending June 30, 1883, is $66,410.51. The work is in the collection district of Wilmington, N. C. The nearest light-houses are at Baldhead and Oak Island at the mouth of the river.

Respectfully submitted.

HENRY BACON,
Assistant Engineer.

Lieut. Col. WM. P. CRAIGHILL,
Corps of Engineers, U. S. A.



COMPARATIVE

SKETCH

Showing AND *Condition*

Improvements made and proposed at the entrance and lower part

OF

CAPE FEAR RIVER N.C.

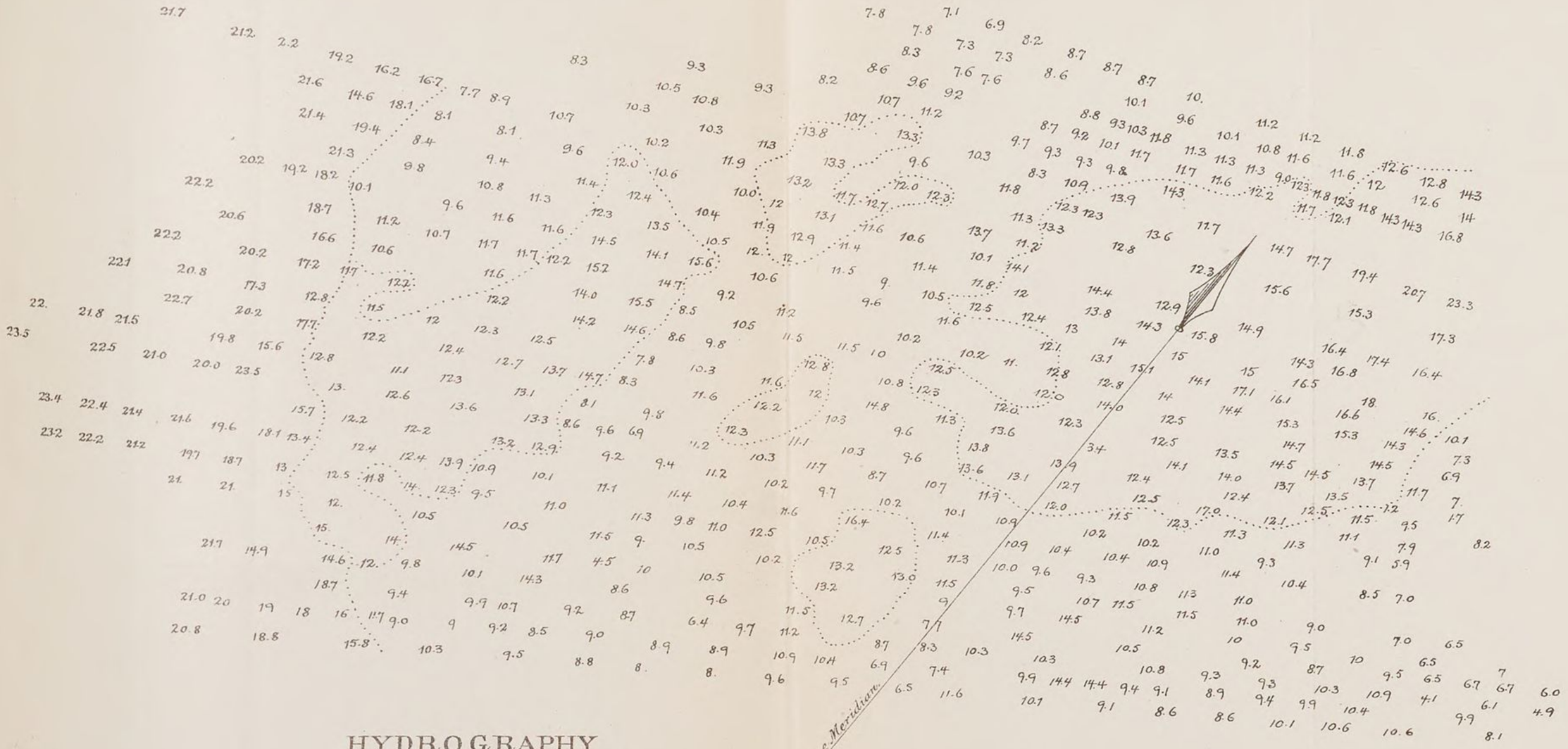
FROM SURVEYS MADE UNDER THE DIRECTION OF LIEUT. COL. WM. P. CRAIGHILL, CORPS OF ENG'RS, U.S.A.

BY HENRY BACON, ASSISTANT.

July 1883. *Scale* 1/40,000

NOTES.

Soundings are expressed in feet.
Dotted shore line shows former condition.
Full " " present "
Curves of 16 ft at mean low water expressed thus: ——
" " 14 " " " " " - - -
" " 12 " " " " " - - -
" " 11 " " " " " —o—



HYDROGRAPHY OF BALDHEAD CHANNEL

From deep water inside of the bar to the sea.

Surveyed under direction of

LIEUT. COL. W. P. CRAIGHILL CORPS OF ENGINEERS U.S.A.

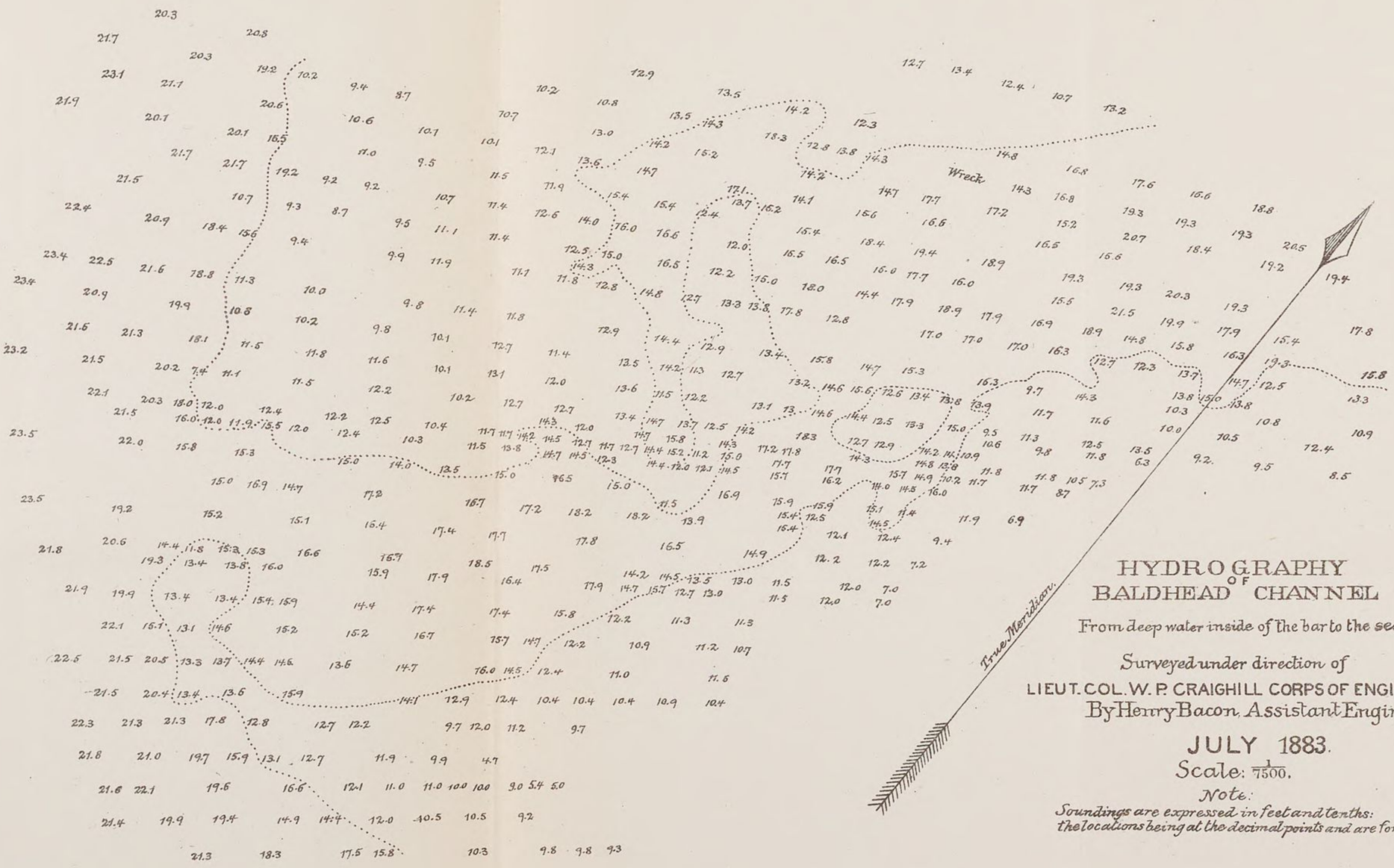
By Henry Bacon Assistant Engineer.

DECEMBER 1877

Scale: 1/7500

Note:

Soundings are expressed in feet and tenths:
the locations being at the decimal points, and are for mean low-water.



HYDROGRAPHY OF BALDHEAD CHANNEL

From deep water inside of the bar to the sea.

Surveyed under direction of
LIEUT. COL. W. P. CRAIGHILL CORPS OF ENGINEERS U.S.A.
By Henry Bacon, Assistant Engineer.

JULY 1883.

Scale: $\frac{1}{7500}$.

Note:
Soundings are expressed in feet and tenths:
the locations being at the decimal points and are for mean low water.

900 ft to Baldhead Lighthouse.

Table showing monthly and general averages of high and low water, Cape Fear River, North Carolina.

Months.	Smithville.				Federal Point, river side of dam.				Federal Point, sea side of dam.				Wilmington.				Rainfall at Wilmington.
	High water.		Low water.		High water.		Low water.		High water.		Low water.		High water.		Low water.		
	Number of observations.	Average height.	Number of observations.	Average height.	Number of observations.	Average height	Number of observations.	Average height.	Number of observations.	Average height.	Number of observations.	Average height.	Number of observations.	Average height.	Number of observations.	Average height.	
1882.		*Feet.*		*Feet.*		*Feet.*		*Feet.*		*Feet.*		*Feet.*		*Feet.*		*Feet.*	*In.*
July	27	4.69	26	0.34	27	4.21	27	0.95	27	4.57	26	0.36	19	4.37	19	2.04	8.89
August	60	5.06	62	0.64	60	4.79	60	1.30	62	4.70	62	0.72	58	5.42	58	2.78	8.09
September	26	5.41	29	1.16	27	5.00	29	1.19	27	4.54	24	0.84	25	5.49	23	2.67	3.34
October	26	5.90	26	1.37	22	4.95	21	1.70	23	5.35	21	1.45	26	5.84	24	3.00	7.57
November	26	5.55	26	1.30	24	5.09	24	1.78	23	5.29	24	1.30	18	5.52	18	2.91	2.78
December	25	4.67	25	0.70	25	4.53	25	1.29	25	4.59	25	0.83	22	5.24	22	2.48	4.02
1883.																	
January	27	4.75	27	0.75	27	4.56	27	1.41	26	4.50	28	0.64	27	5.41	25	3.61	6.33
February	24	4.47	24	0.42	24	4.76	25	1.16	22	4.27	23	0.38	24	5.04	24	2.52	2.09
March	26	4.49	25	0.62	28	4.09	27	1.15	28	4.26	28	0.50	26	5.17	25	2.49	5.78
April	27	4.53	25	0.65	26	4.63	25	1.26	23	4.25	23	0.57	24	5.67	24	3.42	5.01
May	27	5.15	29	0.73	30	4.70	28	1.28	29	4.61	29	0.71	28	5.71	27	2.85	4.79
June	27	4.86	28	0.44	29	4.34	27	0.98	29	4.31	30	0.28	26	5.34	26	2.62	10.84
Summary	348	4.37	352	0.75	349	4.64	345	1.28	344	4.60	343	0.70	323	5.39	315	2.79	69.53

NOTE.—From 186 and 182 observations taken from December 24, 1877, to August 12, 1878, before the New Inlet was fully closed, the average high water at Wilmington was 5.07 and average low water 2.71

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, WILMINGTON, N. C.,
Collector's Office, July 10, 1883.

SIR: I would respectfully inform you, agreeably to your request, that the total receipts at this port from all sources, during the fiscal year ended June 30, 1883, amount to $66,410.51.

The decrease in the receipts for 1883 as compared to those for 1882, is due in a considerable degree to the revision of the tariff laws, and the large amount of goods in bond upon which duties have not been paid.

Very respectfully,

E. I. PENNYPACKER,
Collector.

HENRY BACON, Esq.,
Assistant United States Engineer.

LETTER OF THE PRESIDENT OF THE CHAMBER OF COMMERCE OF WILMINGTON, NORTH CAROLINA.

CHAMBER OF COMMERCE,
Wilmington, N. C., July 2, 1883.

COLONEL: I herewith furnish statistics relating to the ocean commerce of this port, foreign and coastwise, for the past five years.

While the delay in prosecuting the work of contemplated improvements for benefit of commerce, caused by slow progress of contractors for dredging and failure of Congress at its last session to make appropriation for pushing other portions of the work, is to be regretted, there is great cause for rejoicing that all work done since the closure of New Inlet was commenced has resulted as desired, giving evidence of permanent improvement with reason to confidently expect further beneficial results worthy of such liberal appropriation by Congress at its coming session as will insure the early completion of the entire work at present contemplated.

The difficult navigation through the Horseshoe Channel which has been detrimental to commerce can soon be avoided as a passage of greater depth through the Snow's Marsh will be completed in a few days.

The indefatigable energies of Mr. Henry Bacon, the assistant engineer in charge of the work, as also his sound judgment and prudent expenditures in its prosecution, are acknowledged by all persons cognizant of same.

With respects, yours truly,

A. H. VAN BOKKELEN,
President.

Lieut. Col. WM. P. CRAIGHILL,
Corps of Engineers, U. S. A.

Shipments from port of Wilmington, N. C., of principal articles of export for twelve months ending June 30, for five years, 1879 to 1883, inclusive.

Years.	Cotton.	Spirits turpentine.	Rosin.	Tar.	Pitch and turpentine.	Sawed lumber.	Shingles.
1883.	*Bales.*	*Casks.*	*Barrels.*	*Barrels and cases.*	*Barrels.*	*Feet.*	*Number.*
Foreign	55,579	56,762	380,099	26,905	882	9,691,900	2,308,000
Coastwise	72,615	35,545	70,459	57,176	10,486	21,945,265	3,394,421
Total	128,194	92,307	450,558	84,075	11,362	31,636,265	5,702,421
1882.							
Foreign	63,833	58,464	347,504	14,827	111	12,721,000	3,034,000
Coastwise	74,253	29,374	87,288	53,722	8,855	34,718,226	4,033,525
Total	138,086	87,838	434,892	68,549	8,966	47,439,226	7,067,525
1881.							
Foreign	70,483	51,894	438,750	14,547	162	17,079,959	3,820,480
Coastwise	47,705	30,382	48,480	49,113	12,577	26,320,289	4,561,600
Total	118,188	82,276	487,230	63,660	12,739	43,400,248	8,382,080
1880.							
Foreign	36,586	77,651	452,226	11,428	265	9,313,310	3,568,800
Coastwise	40,220	29,378	37,756	45,502	12,968	21,152,583	4,132,500
Total	76,806	107,029	489,982	56,930	13,233	30,465,893	7,701,360
1879.							
Foreign	64,431	84,146	490,265	22,853	587	8,802,960	2,410,650
Coastwise	44,961	16,295	60,933	46,207	10,146	9,546,758	4,692,250
Total	109,392	100,441	551,198	69,060	10,733	18,349,718	7,102,900

Total value of foreign and coastwise shipments, including articles not enumerated above, for years ending June 30, 1883, $12,678,913; 1882, $13,970,900; 1881, $12,503,250; 1880, $10,286,600; 1879, $10,618,800. A portion of the falling off the past year was caused by decrease in ruling prices of articles exported. Value of inward cargoes are estimated at $6,500,000 to $8,500,000 annually.

Statement of steamships and sailing vessels over 60 tons, engaged in ocean commerce only, departing with full cargoes from the port of Wilmington, N. C., for twelve months ending June 30, for five years, 1879 to 1883, inclusive.

Destination.	1883.	1882.	1881.	1880.	1879.
To foreign ports	246	267	302	316	291
Tonnage	83,648	88,000	100,840	96,968	92,724
To coastwise ports	288	334	282	272	249
Tonnage	133,272	149,368	126,642	122,340	117,854
Total vessels	534	601	584	589	540
Total tonnage	216,920	237,368	227,482	219,308	210,578

The demand at other points for the class of vessels for foreign business suited to present state of navigation has been such that sufficient number could not be procured. The decrease in cotton shipments was caused by impossibility to use steamships for early shipments of new crop, foreign and our coastwise steamships being of

small capacity, these difficulties will be overcome and considerable increase result as soon as a depth of 16 feet at low water is obtained from the ocean to city. The dull state of lumber business has caused large falling off in coastwise tonnage. Were all steamers and sailing vessels carrying freight and passengers included in above statement, as at other ports, the departures would approximate 1,000,000 tons.

H 27.

REMOVING SUNKEN VESSELS OBSTRUCTING OR ENDANGERING NAVIGATION.

Complaint having been made February 14, 1883, to the Secretary of War, by Mr. James Bates, that the navigation of Middle River, near Baltimore, was obstructed by a sunken vessel called the Grey Eagle, and request having been presented for its removal, the case was examined into and fully reported upon March 22, 1883, with a recommendation that no further action be taken at present by the War Department, which was approved by the Secretary.

Information having been sought, it was ascertained that efforts were being made to raise and remove the Clara S. It was therefore recommended April 10, 1883, that no further action be taken at present in that case. She was afterwards removed by the Baker Salvage Company, of Norfolk, without expense to the United States.

It was at the same time recommended that the notice required by law be given of the proposed removal of the Cascatelle, which being approved by the Secretary of War, the notice was published in the Baltimore American, and copies thereof sent to the supposed owners of the vessel and cargo. No action having been taken by the owners towards her removal, proposals were invited for that work June 16, 1883.

Petition having been presented for the removal from Chincoteague Bar, Maryland of the hull of the wrecked barkentine Wolverton, examination was made of her. It was found she was obstructing and endangering navigation, and should be removed by the United States, unless the owners or agents take her away. These owners having been written to, promise to effect the removal.

H 28.

SURVEYS FOR A SHIP-CANAL TO CONNECT CHESAPEAKE AND DELAWARE BAYS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., March 3, 1883.

SIR: The river and harbor act of August 2, 1882, appropriated $10,000, or so much thereof as may be necessary, to be expended under the direction of the Secretary of War in completing the surveys for a ship canal to connect the Chesapeake and Delaware bays, and directing him—

To report to Congress which of the various routes surveyed will afford the greatest protection in case of war, and the greatest facilities to commerce by cheapening the cost of transportation from the city of Baltimore to the Atlantic Ocean, together with the cost of said improvement and its approaches, and the annual cost of maintaining and operating said canal when constructed: *Provided*, That nothing herein shall be construed to commit the Government to proceed with the construction of the said improvement.

In obedience to the requirements above quoted, I have the honor to submit herewith copies of the reports of Lieut. Col. W. P. Craighill, Corps of Engineers, and his assistant, Capt. Thomas Turtle, Corps of Engineers, to whom the execution of the surveys was intrusted, which will, it is hoped, furnish the necessary information.

In addition, there are also submitted copies of the letters of Colonel Craighill, dated December 5 and December 20, 1882, referred to in his report. Special attention is invited to the suggestion in these letters that a mixed commission be organized to consider and to report its opinion as to " which of the various routes surveyed will afford the greatest protection in case of war, and the greatest facilities to commerce by cheapening the cost of transportation from the city of Baltimore to the Atlantic Ocean."

With such an opinion to aid his judgment, in connection with the report of the officer making the survey, the Secretary of War will be better able than now to advise Congress as to which of the routes surveyed should be selected.

I therefore fully concur in this suggestion of Colonel Craighill.

Very respectfully, your obedient servant,

H. G. WRIGHT,
Chief of Engineers,
Brig. and Bvt. Maj. Gen.

Hon. ROBERT T. LINCOLN,
Secretary of War.

REPORT OF LIEUTENANT-COLONEL WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., March 1, 1883.

GENERAL: I lose no time in sending forward the report of this date from Capt. Thomas Turtle, Corps of Engineers, concerning the surveys for a canal route between Chesapeake and Delaware bays, of which he has had the special supervision.

These surveys were ordered in the river and harbor act of August 2, 1882. They were taken in hand as soon as possible. The seeming delay has been due to the necessity for additional and deeper borings, in view of the fact that the channel in the Chesapeake Bay and Patapsco, leading to Baltimore, is being deepened, under authority of Congress, from 24 to 27 feet at mean low water, and previous surveys and estimates of cost for the several routes for the canal had been made for a depth for it conforming to the 24-foot channel to Baltimore. These borings have been carefully made, but have taken some time. Their results are shown in detail in Captain Turtle's report, and the specimens are carefully preserved for future study and examination.

The revised estimates on the basis of greater depth increase, of course, the costs of all the routes. The proportional increase is, however, less for the southern route.

Captain Turtle's report also treats the subject of the cost of maintenance.

Attention is invited to my reports of December 5 and December 20, 1882, which, it is requested, may be considered in connection with this one. Other reports of earlier surveys had been previously submitted and printed.

Of the appropriation of $10,000 for these surveys there remains an unexpended balance of $2,500.

Very respectfully, your obedient servant,

WM. P. CRAIGHILL,
Lieutenant-Colonel of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

REPORT OF CAPTAIN THOMAS TURTLE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., March 1, 1883.

COLONEL: I transmit herewith the maps, cross-sections, and note-books of the recent surveys made for a ship-canal to connect the Delaware and Chesapeake bays.

A preliminary report was made, dated February 3, 1882, and printed in Senate Ex. Doc. No. 99, Forty-seventh Congress, first session, and also with your Annual Report (Appendix G of the Annual Report of the Chief of Engineers for 1882, page 950). A summary description of the new route (Back Creek Route) was also given in the same report.

There has since been made a line of levelings across the divide from Millington, Md., on the Chester River, to the landing on Duck Creek, below Smyrna, Del., *via* Blackiston's Cross-Roads, and a number of borings on each of the routes, Back Creek, Sassafras, and Choptank.

The line of levels was made by Mr. M. P. Paret, assistant engineer, and his report, which was accompanied by the adjoined sketch (Plate I), is as follows:

BALTIMORE, MD., *December* 26, 1882.

CAPTAIN: I have the honor to present the following report upon the line of levels run from the head of tide-water on the Chester River, across the peninsula to the head of tide-water on Duck Creek. These levels were run for the purpose of obtaining the elevation of the greatest depression which could be utilized by a possible route of the Chesapeake and Delaware Ship-Canal. The line was started from Millington, Kent County, Maryland, and run over the State road to Smyrna Landing, Kent County, Del., a distance of about 13½ miles. Occasional offset lines were run to give cross-sections of the country and obtain elevations of streams.

At Millington the Chester River is formed by the junction of two streams, called Cypress Branch and Sewell's Branch; the former runs rather too far to the northward to be made available for a ship-canal route. What is called the "Dead Branch" runs into the Cypress Branch near Millington; this stream, lying about three-quarters of a mile to the northward of the State road, runs approximately straight and parallel to it for several miles.

This ("Dead") branch runs dry in summer, which would indicate that its valley followed rather a high depression, the main water-shed being toward the streams on either side. The valley of this branch, in common with those of the Cypress and Sewell's, is heavily wooded nearly throughout. I believe the authorities of the present Chesapeake and Delaware Canal at one time thought of locating their line here and utilizing the "Dead Branch."

Sewell's Branch lies to the southward of the State road and runs comparatively straight from Millington to the boundary line between Maryland and Delaware, at which point it deflects rather sharply to the northward. The valley of this stream varies in width from 100 to 300 yards, up as far as "Turner's Mill," about 1¼ miles above Millington; the mill-pond above here is 1½ miles long and in places one-quarter of a mile wide. The valley of Sewell's Branch could be advantageously used for a location by this route. The valley could be utilized nearly to the boundary line between the States, or for a distance of 4½ miles above Millington. At this point the elevation of the stream is about 30 feet, and about here it would be advisable to strike across more directly to strike the valley of Duck Creek at or near "Murphy's Mill"; at this latter point also the elevation of the stream is about 30 feet. From Murphy's Mill to tide water on Duck Creek it is about 3 miles; two mill-ponds occupy the intervening space, each about 1½ miles in length. From Sewell's Branch at about the boundary line to "Murphy's Mill" is about 6 miles. The elevation of the greatest available depression on such a line occurs near Blackiston's Cross Roads and is approximately 70 feet. As this line would necessarily leave and enter the two valleys rather abruptly, the average cutting on the 6 miles of line from the boundary line to "Murphy's' Mill" would be about 60 feet. Elevations given refer to low water in Chester River. Reference has been made to Martinet's maps of Kent County, Maryland, and Kent County, Delaware, as the only maps available to give information in this section.

Very respectfully, &c.,

MILNOR P. PARET,
Assistant Engineer.

Capt. THOMAS TURTLE,
Corps of Engineers, U. S. A.

This examination was made because it had been alleged in a quarter deserving of consideration that this line offered advantages for the canal route with a maximum elevation of surface of only about 30 feet. It is now shown that the line is not available to the degree claimed.

The borings were made by Mr. N. Goldsborough, assistant engineer. The material taken from each boring was boxed in such a manner that a simple inspection will now, or at any time hereafter, show the depth at which any material was found. The boxes are stored at Fort Carroll, and are properly marked. The locations of the borings on the Back Creek Route are shown on Sheet No. 7 of the survey of 1881; those on the Sassafras Route are shown on the map of that route, made from the survey of 1879, bearing the file-mark 239 R. & H., 1880, Inclosure 2, and those on the Choptank Route are shown upon Sheet No. 20 of the map of surveys made in 1878, which bears the file-mark 5119, R. & H., 1879, Inclosure 8. The description of the borings follow in the order of routes, as follows: Back Creek, Sassafras, and Choptank.

The borings commenced on October 1, at Boring A, on the Back Creek Route, near Chesapeake City, and the diagram of this boring with a section is shown on Sheet of Borings No. 1, and its location on Sheet No. 7 of the survey.

The following is Mr. Goldsborough's report upon it:

BORING A, AT CHESAPEAKE CITY, NEAR O OF CANAL SURVEY OF 1881.

Surface ..... 21′.48 above M. L. W ...	
a	0′.917=thickness of stratum. Dark vegetable soil.
0′.917 below surface... 20′.563 above M. L. W ..	
b	2′.0833=thickness of stratum. Dry yellow clay, containing a small percentage of sand.
3′.0 below surface..... 18′.48 above M. L. W ...	
c	4′.75=thickness of stratum. Tenacious yellow clay, containing a small percentage of sand.
7′.75 below surface.... 13′.75 above M. L. W ...	
d	11′.00=thickness of stratum. Fine sand and gravel, and wet.
18′.75 below surface.... 2′.73 above M. L. W...	
e	3′.75=thickness of stratum. White gravel and coarse sand, and very wet.
22′.50 below surface .... 1′.02 below M. L. W ...	
f	3′.00=thickness of stratum. Mixture of grayish sand and clay, and wet.
25′.50 below surface.... 4′.02 below M. L. W ...	
g	4′.50=thickness of stratum. Variegated clay, the colors being red, brown, and dark and light gray, very tenacious and almost dry.
30′.0 below surface..... 8′.52 below M. L. W...	
h	1′.66=thickness of stratum. Wet sand and clay, the sand largely predominating.
31′.166 below surface... 9′.686 below M. L. W..	
i	17′.00=thickness of stratum. Dark slate-colored clay, dry and very tough. There is a small percentage of fine sand in the clay.
48′.166 below surface... 27′.18 below M. L. W...	
j	2′.833=thickness of stratum. Lead-colored sand and clay. My impression is that the clay brought up by the auger came from the clay stratum above.
51′.00 below surface .... 29′.51 below M. L. W ...	

NOTE.—The material stood up so well that it was found necessary to drive the pipe only 30 feet.

There was no flow of water in this hole, not enough to work the sand augers to any advantage.

The next boring in order is designated as Boring B, on Back Creek Route, and was located near Station 114+50 of the survey of 1881; the location is shown on Sheet No. 7 of that survey, and a section on Station 114, with a diagram of the boring, is shown on Sheet of Borings No. 2.

The following is Mr. Goldsborough's report:

BORING B, ON NORTH SIDE OF CANAL, NEAR TOWPATH, AND OPPOSITE STATION 114 + 50.

Surface elevation..... 21′.53 above M. L. W..	
a.....	2′.5=thickness of stratum. Mixture of fine sand and blue clay.
2′.50 below surface.... 19′.03 above M. L. W..	
b.....	2′.0=thickness of stratum. Blue clay, containing a little sand.
4′.50 below surface ... 17′.03 above M. L. W...	
c.....	1′.666=thickness of stratum. White sand, containing a few pebbles.
6′.166 below surface .. 15′.37 above M. L. W...	
d.....	2′.25=thickness of stratum. Sand, containing pebbles and large stone, some of which had to be broken before they could be brought out through the 6-inch pipe.
8′.41 below surface.... 13′.12 above M. L. W...	
e.....	3′.08=thickness of stratum. Coarse red sand, and a thin crust of dark sandstone.
11′.49 below surface ... 10′.04 above M. L. W...	
f.....	1′.166=thickness of stratum. Red sand and gravel.
12′.65 below surface.... 8′.88 above M. L. W...	
g.....	6′.916=thickness of stratum. Fine yellow sand, free from clay or gravel.
19′.57 below surface.... 1′.96 above M. L. W...	
h.....	0′.75=thickness of stratum. Clean white sand.
20′.32 below surface.... 1′.21 above M. L. W....	
i.....	12′.416=thickness of stratum. Fine yellow sand. Progress very much impeded by stones, which have kept under the pipe since leaving the stratum containing them.
32′.74 below surface.... 11′.21 below M. L. W...	
j.....	2′.50=thickness of stratum. Very coarse yellow sand.
35′.24 below surface.... 13′.71 below M. L. W...	
k.....	2′.00=thickness of stratum. Tough blue clay.
37′.24 below surface.... 15′.71 below M. L. W...	
l.....	3′.25=thickness of stratum. Tough blue clay, with veins of brown and light red running through it.
40′.49 below surface.... 18′.96 below M. L. W...	
m.....	15′.50=thickness of stratum. Tough blue clay, with veins of bright red running through it.
56′.00 below surface.... 34′.47 below M. L. W...	

Boring B C on Back Creek Route is next in order, and was located near Station 170 + 25 of the survey of 1881. The location is shown on Sheet No. 7 of that survey, and a section with the diagram of the boring is shown on Sheet of Borings No. 3, a copy of which is herewith, to be appended to the text and consulted in connection with it. (See Plate II.)

The following is Mr. Goldsborough's report:

BORING B C, ON TOWPATH AT STATION 170+25, AND 2 FEET ABOVE S. W. IN CANAL.

Surface ..... 17′.33 above M. L. W...	
a ..... 4′.166 below surface... 13′.16 above M. L. W...	4′.166=thickness of stratum. Yellow sand mixed with dark-colored mud, indicating artificial or made ground.
b ..... 5′.12 below surface.... 12′.21 above M. L. W...	0′.96=thickness of stratum. Coarse yellow sand.
c ..... 11′.24 below surface.... 6′.09 above M. L. W...	6′.125=thickness of stratum. Fine yellow wet sand.
d ..... 20′.90 below surface.... 3′.57 below M. L. W...	9′.666=thickness of stratum. Coarse yellow sand, containing small lumps of coarse brown sandstone; good flow of water in this stratum.
e ..... 24′.60 below surface.... 7′.27 below M. L. W...	3′.70=thickness of stratum. Fine yellow sand.
f ..... 25′.20 below surface.... 7′.87 below M. L. W...	0′.60=thickness of stratum. Clay and sand mixture of pale yellow color.
g ..... 28′.62 below surface.... 11′.29 below M. L. W...	3′.42=thickness of stratum. Tough pale grayish clay. The flow of water has been very troublesome to-day, and when not disturbed stands within a few inches of the surface.
h ..... 29′.37 below surface.... 12′.04 below M. L. W...	0′.75=thickness of stratum. White sand.
..... 44′.37 below surface... 27′.04 below M. L. W..	15′.00=thickness of stratum. Dark drab-colored clay, containing about 25 per cent. of sand; the color becomes darker and the percentage of sand increases as we get lower down; there are thin layers of sand in this stratum, but as the auger does not indicate them, owing to the thinness of the layers, it is impossible to locate and describe them. Through this stratum the auger has been worked, without inconvenience, from 6 to 8 feet below the bottom of the pipe. At the bottom of this stratum of clay a sand is found very much in appearance like the sand found in Boring C at 90 feet below the surface.
..... 52′.75 below surface.... 35′.42 below M. L. W...	8′.416=penetration in stratum. Fine round sand, and full of water; spent the forenoon driving pipe; in the afternoon cleared the pipe of its contents, which accumulated from the sides of the hole as it was driven down, and then continued driving pipe during the remainder of the day. The progress was very slow, owing to the difficulty in forcing the pipe down, which required from twelve to fourteen strokes of a 500-pound hammer with a lift of 6 feet to drive it 1 inch; the progress made in this stratum during the first day being only 2 feet. Spent the second day trying to make progress in the sand, but without much success; pipe full of water when work was commenced to-day. The bottom of the pipe was found to be 49 feet below the surface, after the accumulation of material from the sides was removed, and the sand-pump comes out full of sand, but it gains nothing in depth, as the sand flows to the pipe as fast as the pump removes it. Second day's progress=1′.7. Work was commenced on the third day early, and the sand-pump used until 9.30 a. m., when it was found that a depth of 50 feet had been obtained; the sand at this depth came in as fast as it could be removed, and in order to get deeper a 1¼′ pipe with a point on it was put down and the hammer put on it, but it could not be driven, the pipe not being stiff enough to bear the force of the hammer. Another experiment was resorted to, which proved partially successful, that of driving the same pipe without the point on the end of it; in this way it was forced down 4′.83, and a core brought out, showing the same material. Having obtained a depth of 52′.75, the boring apparatus was taken down and removed to Boring C.

Passing to the eastward, along the canal, the next boring in order, Boring C, on Back Creek Route, was located (see Sheet No. 7 of the survey of 1881) about opposite Station 214 of the survey, about 530 feet distant from the line, beyond the spoil bank to the north of the canal.

A section at Station 214 with a diagram of the boring is shown on Sheet of Borings No. 4, a copy of which is herewith, to be consulted in connection with the text. (See Plate III.)

Mr. Goldsborough's report is as follows:

BORING C, LOCATED 530 FEET OPPOSITE STATION 214 + 35, ON NORTH SIDE OF CANAL.

Surface ..... 78′.00 above M. L. W...	
a ..... 1′.66 below surface.... 78′.34 above M. L. W...	1′.66 = thickness of stratum. Dark vegetable earth.
b ..... 4′.50 below surface.... 73′.50 above M. L. W...	2′.83 = thickness of stratum. Mixture of fine sand and yellow clay.
c ..... 18′.00 below surface ... 60′.00 above M. L. W...	13′.50 = thickness of stratum. Fine yellow sand containing mica.
d ..... 21′.00 below surface.... 57′.00 above M. L. W...	3′.0 = thickness of stratum. Damp sand and gravel; at 20 feet below the surface water appears.
e ..... 26′.00 below surface.... 52′.00 above M. L. W...	5′.0 = thickness of stratum. Coarse sand and stone. The stones have to be broken in order to take them out through the 6-inch pipe.
f ..... 28′.00 below surface.... 50′.00 above M. L. W...	2′.0 = thickness of stratum. Coarse sand and rotten sandstone.
g ..... 86′.00 below surface.... 8′.00 below M. L. W...	58′.0 = thickness of stratum. Dark-blue sand and clay, and very sticky; about 50 per cent. of this material is sand which has mica in it. It is with difficulty that the auger is drawn up, when full of this material; there is no water in this stratum. At about 50 feet below the surface there is less sand and mica, the percentage growing less as the hole deepens, and at the bottom of it, 86 feet below, there is not more than 25 per cent. of sand.
h ..... 89′.00 below surface ... 11′.00 below M. L. W..	3′.00 = thickness of stratum. Tough, blue, dry clay, containing lumps of iron ore about 1 inch in diameter.
i ..... 90′.00 below surface.... 12′.00 below M. L. W...	1′.00=thickness of stratum. Tough, blue clay containing, perhaps, 25 per cent. of sand.
j	20′.00=penetration in stratum. Fine, round, white sand of bluish tinge, and a great flow of water, which stands 50 feet in the pipe. Great caution had to be exercised in this material to prevent the implements used at the bottom of the pipe being caught by allowing them to be put too deep in the sand. Whenever it occurred it was found almost impossible to extricate them. This stratum was entered on Friday, the 27th of October, on which day the progress was 3.5 feet. The second day was consumed in sand-pumping, but no progress made, the sand flowing into the pipe as fast as we could remove it. Third day used sand pump and auger until noon, the material continuing the same; but little progress made; drove pipe all the afternoon; progress, 4 feet. Fourth day. Experimenting all the morning in the sand, but making little progress. Put water in the pipe, and put the auger in and loosened the material packed in it. The sand-pump was now used, with good results, and the pipe cleaned; filled a bucket with water as it came from the pipe, which was found to be, after it settled, two-thirds sand, with one-fourth of an inch of mud on it. Fifth day. No progress could be made with the pump after getting to the bottom of the pipe, when driving the pipe further down was resorted to. Eight blows of the hammer were required to drive it 1 inch, the hammer falling 6 feet; drove the pipe until the middle of the afternoon. Sixth day. Drove the pipe to the depth of 104 feet, and then screwed the auger to the depth of 110 feet, when we made an ineffectual attempt to draw it. An hour and a half was spent in extricating it. We then used the pump, with little success; next the four-inch screw was used, which loosened the material, after which the sand-pump worked well, and 108 feet was reached. At 4 p. m. the auger was again put in and screwed down to a depth of 110 feet, but brought up nothing, indicating no change in the material.
110′.00 below surface... 22′.00 below M. L. W..	

Still farther eastward is Boring C C, on this route (see Sheet No. 7 of survey of 1881). A section of the present cut, with a diagram of the boring, is shown on Sheet of Borings No. 5, and in order that this section may be consulted in connection with the text, a copy is herewith. (See Plate IV.)

Mr. Goldsborough's report of this boring is as follows:

BORING C C, LOCATED ON TOWPATH AT STATION 220 + 60.

Surface ..... 18′.33 above M. L. W .. *a*	2′.00 = thickness of stratum. Yellow clay mixed with a little black mud indicating made earth.
2′.00 below surface.... 16′.33 above M. L. W... *b*.....	9′.5 = thickness of stratum. Tough, greenish-black and sticky mud, and dry; on the morning of the second day we find a little water in the hole.
11′.5 below surface .... 6′.83 above M. L. W... *c*.....	6′.83 = thickness of stratum. Tough, sticky, dry mud, of lighter color than the stratum above, and showing 25 per cent. of sand in it.
18′.3 below surface..... M. L. W ..... *d*	1′.33 = thickness of stratum. Same material as stratum above, but in color a little greener, with 25 per cent. of sand in it.
19′.6 below surface..... 1′.33 below M. L. W... *e*.....	17′.66 = thickness of stratum. Greenish-black mud, might almost call it green mud, and wet, with 25 per cent. of sand in it; standing over night, the water has risen 8 feet in the pipe, but it does not appear again after once being pumped out.
37′.3 below surface..... 19′.00 below M. L. W... *f*.....	1′.16 = thickness of stratum. Dry, tough clay, free from sand, and drab-colored.
38′.5 below surface.. .. 20′.1 below M. L. W.... *g*	3′.5 = perforation in stratum. A vein of a few inches in thickness of sand and clay is entered, when the water bursts on us and overflows the pipe, the top of which is 6 feet above the level of the towpath; the sand-pump brings up the same white sand that we stopped in and could not get through at B C or at C. We enter this stratum here at 38 feet 6 inches below the surface. Tuesday morning, the 28th November, drove the pipe 3 feet and worked sand-pump until noon. The water was overflowing the pipe when we got to work in the morning, at the rate, we estimated, of 15 gallons per minute; continued sand pumping until night; at times during the day the sand would rise as much as 25 feet in the pipe. The progress of 3.5 feet to-day is due to the sand brought by the overflow of water and not from the sand-pump; a bucket full of this water showed a half-inch of sand on the bottom of the bucket after the water settled.
42′.0 below surface ..... 23′.6 below M. L. W....	

Opposite Station 260 + 80 of the survey of 1881 (see Sheet No. 7) of the Back Creek Route, on the south side of the canal, Boring C D was made. A section with a diagram of the boring is shown on Sheet of Borings No. 6.

Mr. Goldsborough's report is as follows:

BORING C D, ON SOUTH SIDE OF CANAL OPPOSITE STATION 260 + 80.

Surface elevation, 19′.8 above M. L. W	
a	2′.5 = thickness of stratum. Greenish sand and mud.
2′.50 below surface.... 17′.3 above M. L. W....	
b	3′.5 = thickness of stratum. Light yellow sand, mixed with a small percentage of mud, and full of water.
6′.00 below surface.... 13′.8 above M. L. W....	
c	2′.5 = thickness of stratum. A mixture of equal parts of sand and mud, of greenish color.
8′.50 below surface.... 11′.3 above M. L. W	
d	14′ 25 = thickness of stratum. Dark sand and mud, very sticky and wet.
22′.75 below surface.... 2′.95 below M. L. W...	
e	33′.75 = penetration in stratum. Same stratum as above, but material not so wet; would call it dark-greenish sand and mud, and very little water in the material.
56′.50 below surface.... 36′.70 below M. L. W...	

The most easterly boring on the Back Creek Route, made in connection with this survey, is that designated Boring D (see Sheet No. 7 of survey of 1881), a diagram of which, with a section, is shown on Sheet of Borings No. 7.

The following is Mr. Goldsborough's report:

BORING D.

Surface ..... 68′.3 above M. L. W	
a	0′.5 = thickness of stratum. Rich loam, of which 25 per cent. is sand.
0′.5 below surface..... 67′.8 above M. L. W	
b	1′.5 = thickness of stratum. Yellow clay and sand, the percentage of sand increasing as we go down.
2′.0 below surface..... 66′.3 above M. L. W	
c	22′.0 = thickness of stratum. Pale-yellow sand and earth, of which 75 per cent. is sand.
24′.0 below surface..... 44′.3 above M. L. W	
d	6′.0 = thickness of stratum. Yellow sand, containing about 20 per cent. of earth.
30′.0 below surface..... 38′.3 above M. L. W	
e	17′.0 = thickness of stratum. Very dark sand and mud, the sand being about 50 per cent. of the whole. All the material in this boring is dry to the depth of 30 feet, when it becomes damp, and at 41 feet below a little water appears.
47′.0 below surface..... 21′.3 above M. L. W	
f	6′.0 = perforation in stratum. Dark sand, containing 20 per cent. of mud.
53′.0 below surface .... 15′.3 above M. L. W	

On Sheet of Borings No. 10 are shown diagrams of borings made in 1879 near the lower end of Reedy Island in examinations for an ice harbor, the surveys for which were made by the force from the United States Engineer office in Philadelphia.

The borings upon the Sassafras Route began on December 5, and three borings were designated, A, B, and C (see Map of Survey of 1879, with Engineer Department file-mark 239 R and H, 1880, inclosure 2), in

order from east to west, all three being west of Boring No. 1 of the former survey (see Sheet No. 1 of Map of Surveys, 1878, with Engineer Department file-mark 5119 R and H, 1879, inclosure 7.)

Mr. Goldsborough's reports on these borings follow in order.

BORING A.

Surface ..... 69′.00 above M. L. W...	
a ..... 0′.66 below surface.... 68′.34 above M. L. W...	0′.66=thickness of stratum. Dark, sandy soil.
b ..... 3′.0 below surface..... 66′.00 above M. L. W...	2′.33=thickness of stratum. Gray sand and clay, very dry.
c ..... 4′.50 below surface ... 64′.50 above M. L. W...	1′.50=thickness of stratum. Blue sand and earth.
d ..... 13′.50 below surface.... 55′.5 above M. L. W....	9′.00=thickness of stratum. Coarse, yellow sand, containing a few pebbles; in this stratum is found a free flow of water.
e ..... 30′.00 below surface.... 39′.00 above M. L. W...	16′.50=thickness of stratum. Bluish-gray clay, very tenacious and free of grit; the color of this stratum varies a little as it gets deeper, but not sufficiently to make a note of it.
f ..... 39′.0 below surface..... 30′.6 above M. L. W....	9′.00=thickness of stratum. Very dark-colored, wet mud, bluish or grayish color, and very sticky. There was no water in the 16½-foot stratum but in this there is a strong flow, which is standing 20 feet in the pipe.
g ..... 43′.50 below surface.... 25′.50 above M. L. W...	4.′50.=thickness of stratum. This stratum varies very little from the one above it, except in color, which is a little darker. At 42 feet below, strike a big flow of water, which rose 28 feet in pipe; that is, to 55 feet above low water. The pipe in this stratum is driven down with great difficulty, the dark-greenish mud holding the pipe like a vise.
h ..... 56′.50 below surface.... 12′.50 above M. L. W...	13′.00=thickness of stratum. In this stratum is found a compact sand, resembling sandstone, through which the pipe could not be driven, and which had to be pulverized with a churn drill before we could get through it; when reduced, it was removed by the sand-pump. After getting a few feet in this stratum, we find small white flint, and occasionally small shells, cemented into the sand, but after it is subjected to the effects of the drill, it is brought up by the pump in a pulverized mass, and looks as though it had never been cemented.
..... 117′.0 below surface.... 48′.0 below M. L. W...	60′.50=perforation in stratum. Green sand marl, composed of green sand and very small shells cemented together. First day in this stratum we advanced 4½ feet, but it was not reached until late in the day. Second day was consumed by drilling, then boring with the screw auger and sand pumping; progress, 9 feet. Third day. Have to drill into this marl before the auger will take hold of it; in the afternoon attempted to bore without first drilling, but found no progress could be made without changing the bit on the auger. In the effort to bore, the auger, after working it a half hour, brought out a solid core 7 or 8 inches long, which was boxed up and sent as a specimen to the Government office. Fourth day. Boring and sand pumping all morning in the green sand marl. Had the auger adjusted and put in the pipe at 1 p. m., and it now goes into the marl without the assistance of the drill. Progress, 8 feet. Fifth day. Working in the green sand marl all day, which shows less shell and more sand. Progress, 12 feet. Sixth day. Boring and pumping. The material now seems to be in layers, some of them showing a large percentage of fine shells, and then for a foot or two the percentage of green sand predominates. Progress, 13 feet. Seventh day. In the same manner as described above, the bottom of Boring A was reached to day; total depth, 117 feet. Stopped in the green sand marl. The pipe in this hole was only driven 56 feet; the walls of the boring stood up so well that it was useless to drive it deeper. Left the hole nearly full of water.

BORING B.

Surface ..... 53′.0 above M. L. W....	
a ..... 0′.75 below surface .. 52′.25 above M. L. W...	0′.75=thickness of stratum. Dark surface soil.
b..... 5′.50 below surface.... 47′.50 above M. L. W...	4′.75=thickness of stratum. Yellow clay.
c ..... 10′.0 below surface..... 43′.00 above M. L. W...	4′.50=thickness of stratum. Drab-colored clay.
d ..... 15′.00 below surface.... 38′.00 above M. L. W.....	5′.00=thickness of stratum. Pale-yellow clay.
e..... 16′.75 below surface.... 36′.25 above M. L. W...	1′ 75=thickness of stratum. Porous, black, and dry earth.
..... 64′.00 below surface.... 11′.00 below M. L. W...	47′.25=thickness of stratum. Green sand marl and a flow of water, which is, at the beginning, taken out with the sand-pump; sand predominates to a very great extent, there being probably not more than 25 per cent. of mud. The first day's progress in this is 15 feet. Second day. The green sand marl that we stopped in yesterday shows small particles of shell at 34 feet below the surface; at 36 feet below it becomes very compact. and at 37 feet below the surface the material is so much harder that the auger had to be sent to a shop to be sharpened; during its absence we have been churning the bottom of the hole with a drill, but have made but little progress; the material at the close of the day shows dark green sand, with few small white shells, and is very hard. Progress to-day, 9 feet. Third day. Material same green sand marl. Progress to-day, 10 feet. Fourth day. Same green sand marl, in which we worked 13 feet when we got through the stratum.
f..... 95′.00 below surface.... 42′.00 below M. L. W...	31′.00=penetration in stratum. Dark-gray or steel-colored sand, which is stirred up by the auger and then taken out with sand-pump. Second day. Boring and sand-pumping all day. Progress, 10 feet. Third day. Material the same dark-gray or steel-colored sand, but at times progress was impeded by water, and by noon we had gained only 4 feet; in the afternoon we gained nothing in depth, but took out a large quantity of sand and water, which must have come in from the sides below the bottom of the pipe. Progress, 4 feet. Fourth day. The walls of the boring stood up to-day, and we made 10 feet by noon, which completed this boring. Progress, 10 feet. Total depth, 95 feet.

BORING C.

Surface ..... 17′.0 above M. L. W....	
a..... 1′.33 below surface .... 15′.67 above M. L. W ...	1′.33=thickness of stratum. Yellow sand and clay.
b ..... 10′.63 below surface .... 6′.37 above M. L. W ...	9′.30=thickness of stratum. Bright yellow sand.
c..... 12′.38 below surface .... 4′.62 above M. L. W ...	1′.75=thickness of stratum. Yellow sand, containing 25 per cent. of mud.
d ..... 18′.48 below surface .... 1′.48 below M. L. W ...	6′.10=thickness of stratum. Bright yellow sand, and coarser than above it.
e ..... 20′.06 below surface .... 3′.06 below M. L. W ...	1′.58=thickness of stratum. Very coarse, yellow sand and small pebbles.
f..... 21′.72 below surface .... 4′.72 below M. L. W ...	1′.66=thickness of stratum. Dark, green mud, with coarse sand mixed through it.
g..... 26′.30 below surface .... 9′.30 below M. L. W ...	4′.58=thickness of stratum. Coarse, bluish sand, and very hard to bore into.
h..... 27′.55 below surface .... 10′.55 below M. L. W ...	1′.25=thickness of stratum. Very coarse sand and pebbles.

BORING C.—Continued.

i	31′.66 = perforation in stratum. Hard, green sand marl, and hard to bore into. First days' work in this material we went into it 24 feet, and on the second day by noon 7.6 feet. Total depth, 59.2 feet. The material we stopped in is green sand without shells and the auger worked well without the aid of the drill. Used in this hole only 31 feet of pipe. The walls of the boring stood up well.
59′.21 below surface 42′.21 below M. L. W	

The borings made on the Choptank Route this year are three in number, and the locations are shown on sheet No. 2 of Maps of Surveys, 1878, before referred to. All were made on the divide between the Nanticoke and Broadkill, and the boring was commenced January 16, 1883.

Mr. Goldsborough's reports on the three borings here follow in order.

BORING A.

Surface 55′.0 above M. L. W	
a	0′.58=thickness of stratum. Dark sand and surface soil.
0′.58 below surface 54′.42 above M. L. W	
b	4′.25=thickness of stratum. Sand mixed with a small percentage of clay and earth.
4′.83 below surface 50′.17 above M. L. W	
c	6′.17=thickness of stratum. Lead-colored sand, with small percentage of mud.
11′.00 below surface 44′.00 above M. L. W	
d	5′.00=thickness of stratum. Clear and clean sand, with water sufficient to work sand-pump first met at 16 feet below the surface.
16′.00 below surface 39′.00 above M. L. W	
e	16′.00=thickness of stratum. Clean sand varying a little in color, which is generally yellow.
32′.00 below surface 23′.00 above M. L. W	
f	6.′00=thickness of stratum. Fine sand and an abundance of water.
38′.00 below surface 17′.00 above M. L. W	
g	51′.00 = Perforation in stratum. Coarse sand and gravel. After entering this stratum the sand flowed into the pipe so rapidly that the pump was worked four hours without gaining an inch. We then put on two short sections of pipe and sent it down. We then used the sand-pump rapidly, and got down to the depth of 48 feet below the surface, when the sand forced its way up the pipe 11 feet, the hole now only measuring 37 feet from the surface. The sand stopped at this level, and the sand-pump again went down, gaining rapidly, and at night showed a depth of 43 feet below the surface, or within 5 feet of the bottom of the pipe. I am under the impression that the sand is caving in around the pipe from a depth of 12 feet below the surface, where we first struck water, and that it is this sand that is coming up in the pipe. Second day in this stratum, commencing at 3 p. m. Sand-pump worked well; material clean white sand, and so loose that the pipe would follow down of its own weight without any assistance. This sand does not solidify after settling, and is more easily moved with the pump than any material we have bored into on the peninsula. It is full of water, and we cannot gain one inch on it below the bottom of the pipe. We take out at least five times the quantity of material contained in the 6-inch hole, showing thereby that it is constantly caving. This loose condition began at the top of the stratum, and we stop in it to-day. We have gone in this stratum 20 feet since the rain of this forenoon, or in about two hours. Plenty of water. Third day. At the depth of 70 feet below the surface the sand changes to a bright yellow color and at 76 feet below the pipe refuses to go without a little assistance, and upon pumping out the hole and measuring, and then putting in the auger (which is the first time it has been used since we left the surface), we find a very fine yellow sand, with a little clay mixed with it, and the clay comes up in lumps. The clay disappears in a few inches, and we continue to go down easily in the fine bright yellow sand; this material continues to within 1½ feet of the bottom of the boring, when we go through a thin vein of a peculiar yellow sand, we then enter a coarse sand, in which we stop at a depth of 89 feet below the surface.
89′.00 below surface 34′.00 below M. L. W	

While working in this hole, Mr. Goldsborough reported as follows on January 18:

We are in sand here from the surface as far as we have gone, viz, 36 feet. At about 30 feet down the sand began to flow into the pipe, and following the pump as it was drawn up, it has sometimes filled the pipes as much as 7 feet from the bottom, I am now going to send the pipes down 7 or 8 feet further and then try the material again.

BORING B.

Surface ..... 53′.0 above M. L. W	
a ..... 0′.46 below surface .... 52′.54 above M. L. W ...	0′.46=thickness of stratum. Dark surface soil of sand and loam.
b ..... 2′.79 below surface .... 50′.21 above M. L. W ...	2′.33=thickness of stratum. Equal parts of grayish earth and sand.
c ..... 9′.29 below surface .... 43′.71 above M. L. W ...	6′.50=thickness of stratum. Plastic clay of lead color.
d ..... 11′.54 below surface .... 41′.46 above M. L. W ...	2′.25=thickness of stratum. Lead-colored clay, very like that above it.
e ..... 13′.04 below surface .... 39′.96 above M. L. W ...	1′.50=thickness of stratum. Yellow sand and clay, the sand being 75 per cent. of the whole.
f ..... 16′.04 below surface .... 36′.96 above M. L. W ...	3′.00=thickness of stratum. Coarse yellow sand, in which is found a big flow of water that came to within 3 feet of the surface, had to drive pipe below the vein to get clear of it.
g ..... 19′.70 below surface .... 33′.30 above M. L. W ...	3′,66=thickness of stratum. Coarse white sand, containing small white pebbles.
h ..... 25′.03 below surface .... 27′.97 above M. L. W ...	5′.33=thickness of stratum. Very fine white sand, in which we find another flush of water, which rose to within 2 feet of surface. We endeavored to pump this water down but night stopped us, after pumping 1 hour, in which time the water was reduced 10 feet. Second day. Water within 3½ feet of surface and the pipe filled 7 feet from the bottom with sand; 5 feet of this sand was taken outwhen it began to come in again as fast as it could be taken out, and we had to put down more pipe to get below it.
i ..... 30′.03 below surface .... 27′.97 above M. L. W ...	5′.00=thickness of stratum. Very pale yellow coarse sand.
j ..... 48′.03 below surface .... 4′.97 above M. L. W ...	18′.00=thickness of stratum. Very white coarse sand containing small pebbles.
k ..... 55′.03 below surface .... 2′.03 below M. L. W ...	7′.00=thickness of stratum. Coarse pale-yellow sand, containing some small pebbles. From 25 feet below to 55 feet below the pipe followed the sand-pump without assistance; before stopping work the water was pumped out without difficulty. Third day Water when work was resumed was within 6 feet of surface, and sand up in the pipe 7 feet from the bottom.
l ..... 63′.03 below surface .... 10′.03 below M. L. W ...	8′.00=thickness of stratum. Coarse sand and gravel. Between 55 and 59 feet below surface another stream of water was found; a half hour's rapid pumping reduced it to 8 feet of the bottom, after which the pump could not reduce it; pipe followed the pump easily to 63 feet below. At noon, depth of boring = 67 feet; the water in it after the dinner hour measured 64 feet; that is, it stood within 3 feet of the surface, and 30 minutes' pumping exhausted it.
m ..... 66′.03 below surface .... 12′.03 below M. L. W ...	3′.00 = thickness of stratum. Very coarse sand.
n ..... 68′.53 below surface .... 15′.53 below M. L. W ...	2′.50 = thickness of stratum. Pale-yellow sand and gravel.
o ..... 70′.03 below surface .... 17′.03 below M. L. W ...	1′.50 = thickness of stratum. Dark-yellow sand.

BORING B—Continued.

p 70′.78 below surface 17′.78 below M. L. W	0′.75 = thickness of stratum. Lead-colored clay.
q 76′.03 below surface 23′.03 below M. L. W	5′.25 = thickness of stratum. Yellow sand,
r 76′.53 below surface 25′.53 below M. L. W	0′.50 = thickness of stratum. Lead-colored clay.
s 79′.53 below surface 26′.53 below M. L. W	3′.00 = thickness of stratum. Sand. Water, when work was stopped in this stratum at night, was found to be within 4 feet of surface; spent a day sand-pumping and bringing out quantities of fine, round, yellow sand and water, without gaining on either sand or water; next day drove pipe down, which goes slowly; put the auger in and find clay.
t 80′.03 below surface 27′.63 below M. L. W	0′.5 = thickness of stratum. Clay.
u 83′.03 below surface 30′.03 below M. L. W	3′.00 = thickness of stratum. Fine, round, yellow sand. This sand seems to settle around the pipe, causing it to drive hard.
v 83′.53 below surface 30′.53 below M. L. W	0′.50 = thickness of stratum. Clay.
w 90′.03 below surface 37′.03 below M. L. W	6′.50 = perforation in stratum. Fine, round, yellow sand, in which we step, 90 feet below surface; water standing in the pipe within 4 feet of surface.

BORING C.

Surface 50′.00 above M. L. W	
a 0′.50 below surface 49′.50 above M. L W	0′.50 = thickness of stratum. Dark sand surface earth.
b 3′.00 below surface 47′.00 above M. L. W	2′.50 = thickness of stratum. Yellow sand.
c 6′.00 below surface 44′.0 above M. L. W	3′.00 = thickness of stratum. Gray sand.
d 8′.50 below surface 41′.50 above M. L. W	2′.50 = thickness of stratum. Mixture of yellow clay and sand.
e 10′.0 below surface 40′.0 above M. L. W	1′,50 = thickness of stratum. Yellow sand and gravel.
f 11′.0 below surface 39′.0 above M. L. W	1′.00 = thickness of stratum. Mixture of sand and clay.
g 15′.0 below surface 35′.0 above M. L. W	4′.00 = thickness of stratum. Blue clay.
h 49′.17 below surface 0′.83 above M. L. W	34′.17 = thickness of stratum. Fine yellow sand containing only enough water for the sand-pump to work.
i 53′.0 below surface 3′.00 below M. L. W	3′.83′= thickness of stratum. Water within 8 feet of the surface when we began work this a. m. White sand and fine gravel.
j 60′.0 below surface 10′.0 below M. L. W	7′.00 = thickness of stratum. Coarse yellow sand and gravel.
k 73′.00 below surface 23′.00 below M. L. W	13′.00 = thickness of stratum. Very coarse white sand, gravel, and small stone.
l	11′.00 = thickness of stratum. Fine round blue sand. At 72 feet the pipe dropped 4 feet as suddenly as though there was nothing under it

BORING C—Continued.

84′.00 below surface.... 34′.00 below M. L. W...	
m.....	6′.00 = perforation in stratum. Coarse white sand, stone and pebbles. When work was begun this morning there were 40 feet of water in the pipe; stopped at night at 87 feet. In the morning following there was 81 feet of water. The bottom of this boring was in a bed of stone from 1 to 3 inches in diameter and about 3 feet thick. Water was standing in the pipe when we stopped, to within 6 feet of the surface, and the earth around the pipe was caving from the surface; it began caving when we were about 40 feet below the surface. Upon the completion of this boring Mr. Goldsborough telegraphed me there was no improvement over Borings A and B.
90′.00 below surface.... 40′.00 below M. L. W ..	

In considering what influence the information obtained by the borings may have upon the choice of a route, it seems that those upon the Back Creek Route and those upon the Sassafras Route may in a measure be taken together, and from this comparison, in conjunction with the estimates of quantities and cost upon any assumed basis of dimensions and side slopes, it may be determined which of these routes should be adopted as the project for a northern line to be contrasted finally with the southern or Choptank Route.

Boring C, upon the Back Creek Route (see Plate III), affords a good point of departure in this discussion. The present canal was intended to be 10 feet in depth, 36 feet wide on the bottom, and 66 feet wide at the surface. A section is indicated with these dimensions with side slopes above the water surface of "one and one-half to one," otherwise 2 to 3. (Similar sections are indicated on Plates II and IV.) The natural surface at the section shown on Plate III was about 80 feet above mean low water, and the depth of cutting for the present canal was about 75 feet. The form which this section has taken is chiefly due, without doubt, to the stratum marked *g*, consisting of sand with mica and clay, the proportion of the latter increasing from 50 per cent., as stated, from the top of the stratum, to about 75 per cent. at the bottom. Attention is called to this feature as illustrating the well-known instability of slopes in cuttings through clays.

Upon the Sassafras Route clay strata are shown by Boring A of this year overlying the compact and cemented strata of sand and shells, and in Borings Nos. 1 and 2 of the survey of 1878–'79.

After getting through this stratum *g* of Boring C, on the Back Creek Route, and strata *h* and *i* below it, the stratum of water-laden sand was reached, a feature which was recognized as requiring careful examination and development. We had here a stratum of sand, the surface of which was 12 feet below the mean low-water surface of the Chesapeake Bay, overlaid with clays of very considerable thickness. The sand was found, under the influence of the water it contained, to run freely to the bottom of the pipe and up the pipe for several feet. The head of water in this sand was such that the water stood in the pipe certainly 28 feet or more above the level of the bay and all of 13 feet above the level in the canal near by, or as much as 40 feet above the surface of the stratum containing it. There were thus unmistakable proofs of a very great and extensive reservoir of supply, and the sand was of unknown depth, the penetration being 20 feet; 15 feet of the lower portion of the prism of the projected ship-canal would pass through a stratum with the elevation of this. Boring B C, Plate II, and Boring C C, Plate IV, were made principally to develop this stratum of water-laden sand. In Boring B C, it was reached at the level of the bottom of the proposed ship-canal,

and the dredging would fairly penetrate and uncover it, though it is probable that a head of 30 feet of water would cause its influence to be felt, even if the canal prism did not reach it within some feet. At Boring C C the stratum was entered at 20 feet below low water. (See Plate IV, stratum *g*). And here the boring being on the tow-path, the phenomena had full opportunity for display, as the description of this boring shows. The excavation for the proposed ship-canal would probably be within the influence of this stratum for a distance of from 6,000 to 7,000 feet.

No further mention of the other borings upon this line need, I think, be here made, as it is supposed that the fate of this route will hinge upon the study of these Borings B C, C, and C C.

The borings made in the previous survey upon the Sassafras Route did not develop this stratum of water-laden sand, and it could be assumed with much positiveness that if it existed at all at a depth to be encountered in the excavation, it would be found to the westward of the borings previously made.

This stratum was not met with in either of the three holes bored, though in Boring B, at the depth of from 18 to 22 feet below low water, the work was impeded and no progress was made in an entire afternoon, a large quantity of sand being taken out which must have come in from the sides where unsupported by piping. There was no rising of sand in the pipe upon the Sassafras Route. The very important discovery was made, however, of the strata of very hard cemented sand and marl beds, of which the descriptions give an idea. The fragments of cemented sand and pebbles, and the core of sand and shells obtained from the borings and the rate of progress, indicate much harder materials than had been heretofore thought of. From the incomplete data which the borings afford, it is judged that the amount of this material to be taken out will reach 3,500,000 cubic yards, and that the estimates of cost must be increased by perhaps $1,000,000, because of it. This material while being costly to excavate will form very stable slopes for the canal prism, and in that view will be not without advantage.

The section of country through which the Choptank line passes, as shown by the borings on the two surveys (1878–'79 and 1881–'83), is entirely different from that of the northern lines. On the surface is a thin sandy soil, overlying sand with varying proportions of clay and earth mixed, under which in places between the Nanticoke and the Broadkill is a layer of clay. Underneath this surface series, which is more or less complete on the whole line, there is found sand very thoroughly saturated with water. This feature of all the developments upon this line is of most interest. In the borings at Hicksburg and Hearn's, between Ferry Creek and Walnut Landing, we find from the sections made after the former surveys (with the Engineer Department file-mark 5119 R. & H., 1879, inclosure 14) a stratum of "fine sharp sand, saturated with water, semi-fluid"; the same on the section of the boring at Torberts, near the head of the Nanticoke. We find the same on the section of the boring at Farmington, upon the Queenstown line, about 4 miles south of Harrington. Borings A, B, and C, made this year, as the descriptions show, passed through sand filled with water, under the influence of which it moves with great facility. To what degree this saturation changes with the seasons is not known. Referring to the diagram of Boring A on Sheet of Borings No. 9, and to the description of this boring above, it will be seen that the character of the surface strata does not indicate that they would hold water to any great degree;

yet there is a well about 12 feet deep near this boring (perhaps 150 yards distant), which, as told me by the man living near, never runs dry. This leads to the supposition that sand below remains well saturated the year round. At all the borings water was found to stand considerably higher than the surface of the strata from which it came. The descriptions above give all the information collected during the borings, and further remarks would be but repetitions of them.

COMPARATIVE ESTIMATES.

The estimates of the former reports were based on a depth of 24 feet at mean low tide. The deepening of the approaches to Baltimore Harbor to 27 feet at mean low tide requires that the estimates shall be made for that depth. Estimates are here presented in which the following elements are assumed: Depth, 27 feet; width on bottom, 100 feet; side slopes, 2 on 3 throughout; tow-path, 12 feet wide. These estimates are in their nature comparative, no account being taken of those portions in which the side slopes may not stand at the inclination assumed, and in which the prism with these dimensions may be obtained and maintained with difficulty; neither are any estimates made for revetting the slopes where it may be found desirable. It is deemed only necessary at this stage of the question to make the estimates within the limits assumed.

CHOPTANK ROUTE.

Excavation above high water, 39,184,148 cubic yards, at 20 cents	$7,836,829 60
Excavation between high and low water, 6,635,007 cubic yards, at 15 cents	995,251 05
Excavation below low water, 34,781,735 cubic yards, at 12½ cents	4,347,716 87
Dredging in Delaware Bay to 27 feet depth, 1,711,600 cubic yards, at 10 cents	171,160 00
Dredging in Nanticoke, former estimate, 10,000,000 cubic yards, at 10 cents	1,000,000 00
Dredging in Nanticoke for increase of depth, 5,963,536 cubic yards, at 10 cents	596,353 60
Dredging in Choptank and Ferry Creek, former estimate, 860,000 cubic yards, at 10 cents	86,000 00
Dredging in Choptank and Ferry Creek for increase to 27 feet depth, 1,547,946 cubic yards, at 10 cents	154,794 60
Road bridges, four, at $52,500 each	210,000 00
Railroad bridges, three, at $90,000 each	270,000 00
Tide locks, three, at $229,500 each	688,500 00
Land damages, 3,500 acres, at $50	175,000 00
Ten per cent. for contingencies	1,653,160 57
Total	18,184,766 29

SASSAFRAS ROUTE.

Excavation above high water, 20,524,346 cubic yards, at 20 cents	$4,104,869 20
Excavation between high and low water, 2,389,758 cubic yards, at 15 cents	358,463 70
Excavation below low water, 13,054,619 cubic yards, at 12½ cents	1,631,827 37
Dredging in Sassafras above Georgetown, 5,583,280 cubic yards, at 10 cents	558,328 00
Dredging in Sassafras below Georgetown, 12,487,825 cubic yards, at 10 cents	1,248,782 50
Dredging in Chesapeake below Howell's Point, 1,804,467 cubic yards, at 10 cents	180,446 70
Dredging outer end of Brewerton Channel, 4,132,836 cubic yards, at 10 cents	413,283 60
Dredging in Delaware Bay, 2,990,533 cubic yards, at 10 cents	299,053 30
Protection walls, Delaware entrance, former estimate	30,000 00
Railroad bridges, former estimate	180,000 00

Common road bridges, former estimate	$157,500 00
Land damages, former estimate	72,000 00
Tide lock, former estimate	229,000 00
Contingencies on the above, estimates 10 per cent	946,355 44
Probable increase for hard material	1,000,000 00
Total	11,409,909 81

This estimate does not include the cost of obtaining possession of any chartered rights now existing over the line. If the opening of the Brewerton Channel eastward of the cut-off be omitted nearly $500,000 will be saved on this estimate.

BACK CREEK ROUTE.

Excavation above high water, 6,951,344 cubic yards, at 20 cents	$1,390,268 80
Excavation between high and low water, 2,171,530 cubic yards, at 15 cents	325,729 50
Excavation below low water, 12,898,616 cubic yards, at 12½ cents	1,612,327 00
Dredging in Back Creek, 6,004,523 cubic yards, at 10 cents	600,452 30
Dredging in Elk River, 5,115,600 cubic yards, at 10 cents	511,560 00
Dredging Turkey Point to Sassafras, 5,890,667 cubic yards, at 10 cents	589,066 70
Dredging below Howell's Point, 1,804,467 cubic yards, at 10 cents	180,446 70
Dredging outer end Brewerton Channel, 4,132,836 cubic yards, at 10 cents	413,283 60
Dredging in Delaware Bay, 6,012,150 cubic yards, at 10 cents	601,215 00
Dredging canal to Delaware City, 282,153 cubic yards, at 10 cents	28,215 30
Protection works, Delaware Bay	30,000 00
Tide lock	229,000 00
Railroad bridge	90,000 00
Five common road bridges	262,500 00
Land damages	50,000 00
Contingencies, 10 per cent	691,406 49
Total	7,605,471 39

In this estimate no account is taken of the cost of obtaining full and unencumbered possession of the present canal and its property. As in the case of the Sassafras line, nearly $500,000 would be saved by omitting the opening of the Brewerton Channel eastward of the cut-off.

NOTES UPON THE MILITARY CONSIDERATIONS.

It will be doubted by no one that a deep-water connection between the two bays would be of vast importance in the contingency of war with a maritime nation. Such a connection would provide a means of concentrating the floating defenses of the two bays, and besides this, would render more secure the communication between the naval stations of Philadelphia and Norfolk and Washington. Vessels defending a port have two offices to perform, the one being to assist in the direct defense, or to prevent capture or occupation by a hostile force, the other being "the prevention or breaking up of blockades." Without the canal a blockade at the capes of the Delaware would close the ports of Philadelphia, or a blockade at the capes of Virginia would close the outward commerce of Baltimore and the other ports of the Chesapeake. With the canal built where communication would be secure, neither the ports of Philadelphia nor of Baltimore could be closed unless an effectual blockade were established both at the Delaware and Virginia capes. The disadvantage to the attacking party is obvious, while the defending vessels could concentrate at either outlet, and breaking the blockade at one point would open both ports and render the blockade useless at the other outlet.

It may be assumed that if a war with one of the great naval powers

Plate 1

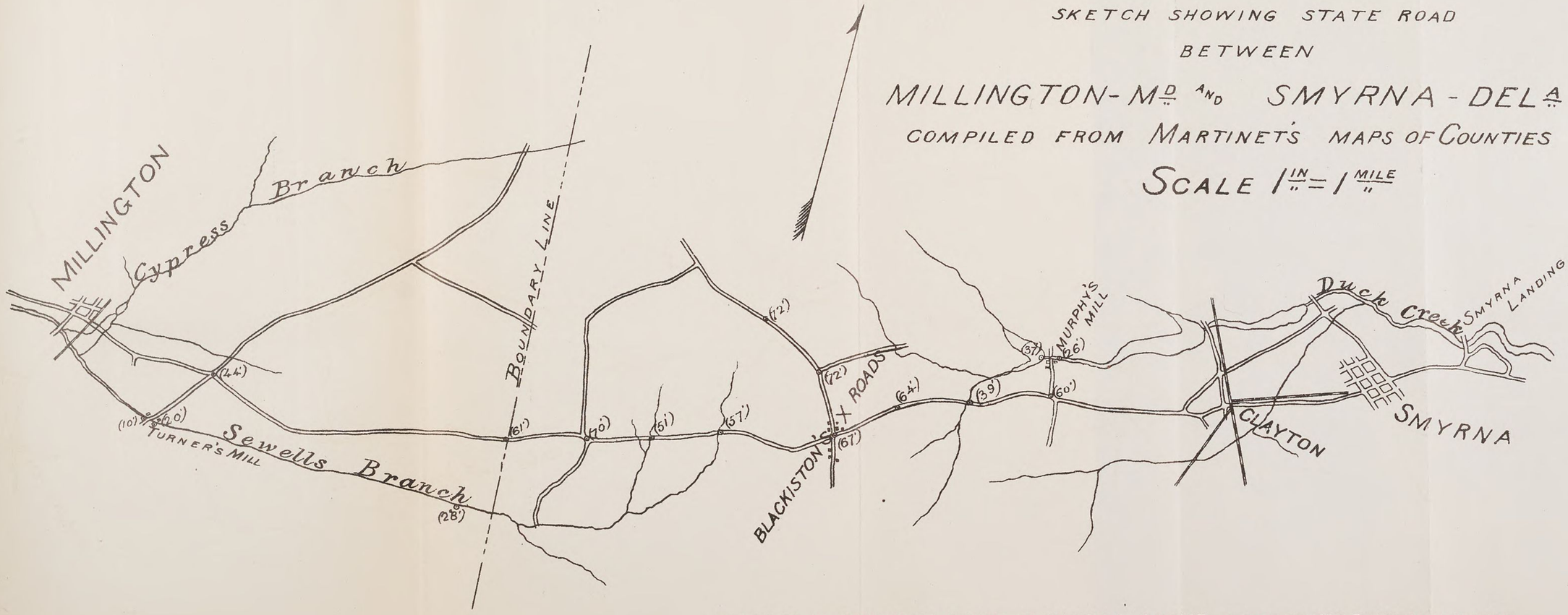
SKETCH SHOWING STATE ROAD

BETWEEN

MILLINGTON-Md. AND SMYRNA-Del.

COMPILED FROM MARTINET'S MAPS OF COUNTIES

SCALE 1 IN. = 1 MILE



FIGURES IN BRACKETS SHOW ELEVATION ABOVE LOW WATER AT MILLINGTON.

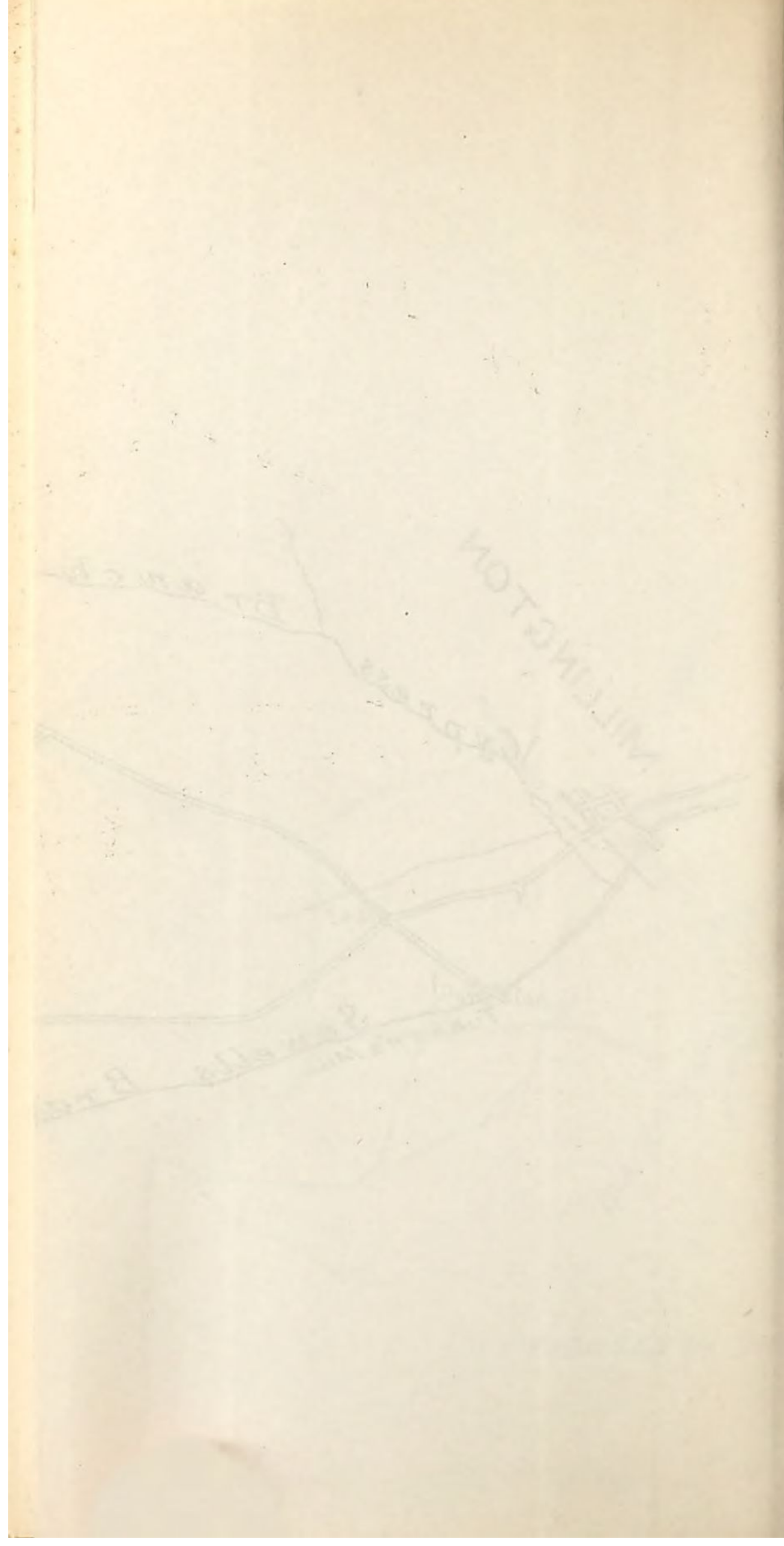


Plate 2.

C. AND D. CANAL SURVEY 1881.
BACK CREEK ROUTE.
SHEET OF BORINGS NO. 3.

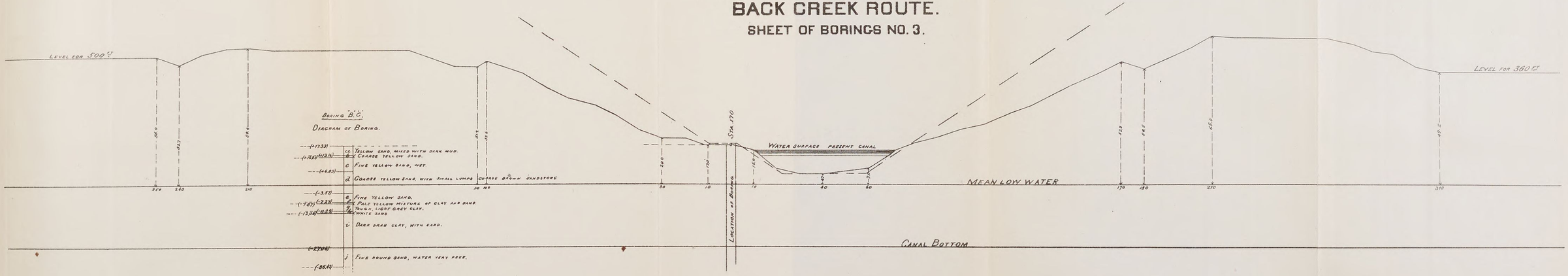


Plate 3.

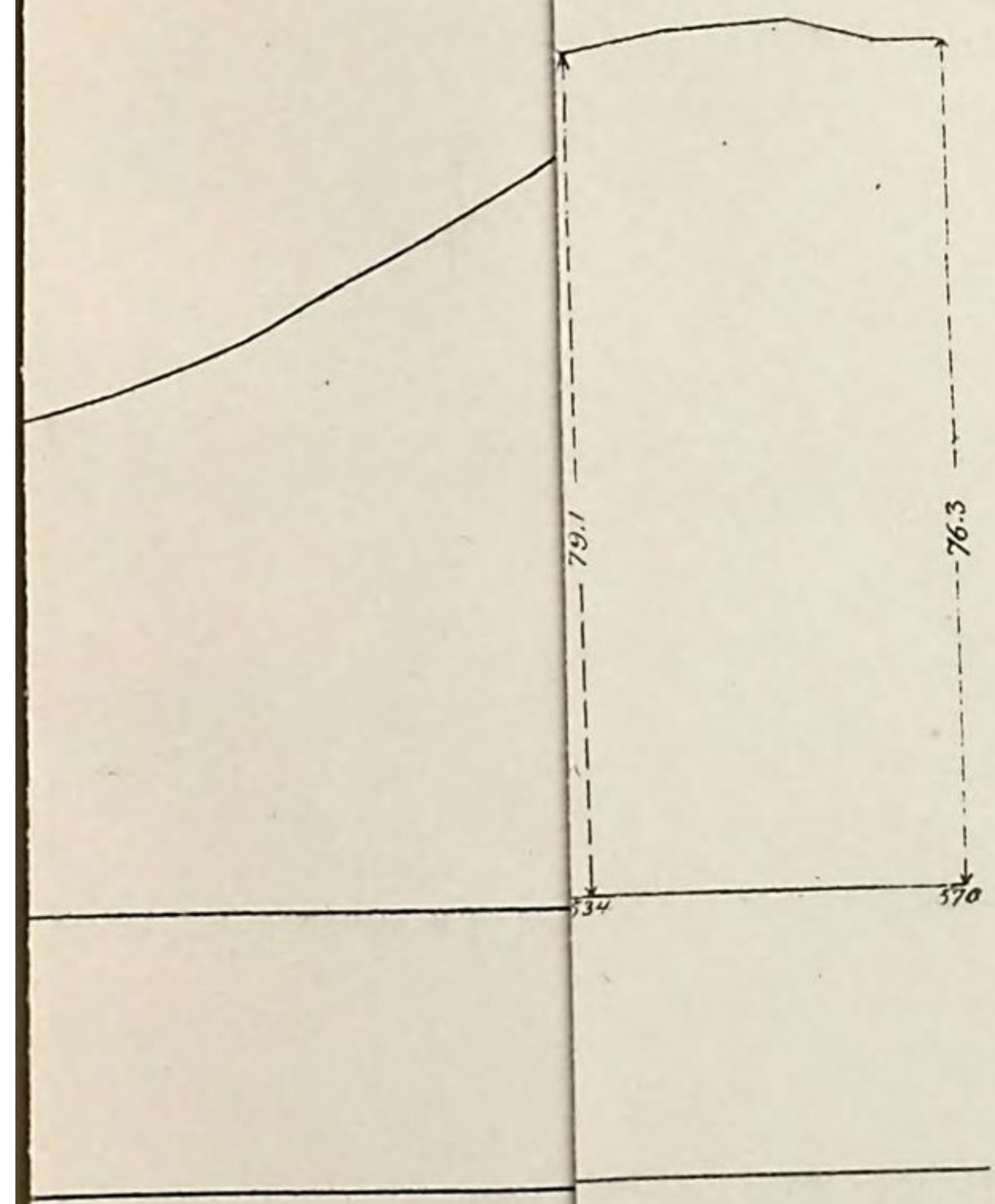
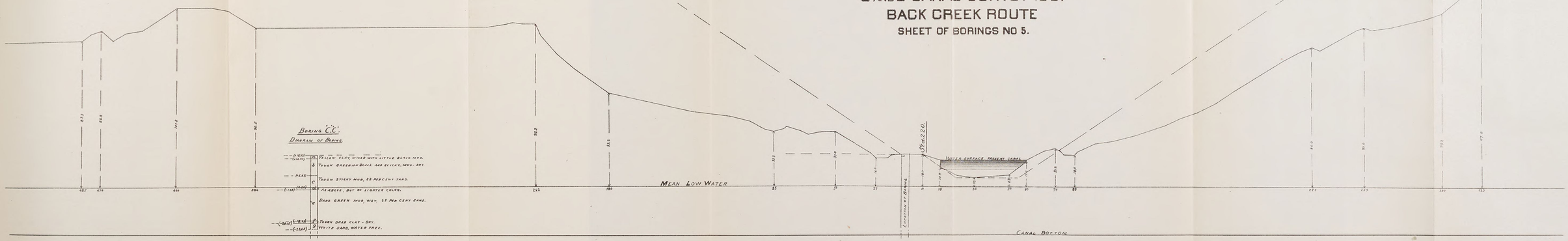


Plate 4.

C AND D CANAL SURVEY 1881
BACK CREEK ROUTE
SHEET OF BORINGS NO 5.



should arise, and the mere appropriation of the money could provide such a channel of communication between the bays, the amount would be at once provided without hesitation. That would, however, be too late.

When the question of defense is considered in the choice of a route, the elements are rapidity and security of communication, and in making the comparison the Sassafras and the Choptank routes will first be considered.

Rapidity will be first investigated. In the former reports in calculating the relative times of transit it was assumed that vessels could make 5 miles per hour in canal, 7 miles per hour in dredged channels, and 10 miles per hour in the bays, and the same rates are now assumed. The question will now depend upon the point of rendezvous, and the harbor of the Delaware Breakwater will be taken first. A vessel could pass through to the mouth of the Choptank River by the Choptank Route, thus covering Baltimore and Annapolis in about eleven and a quarter hours, while, if compelled to take the Sassafras Route, it would still be within the mouth of the Sassafras River. The disadvantage in the latter case would be that about five hours and twenty minutes would be lost if it were necessary to proceed to the defense of the Potomac or a point in the lower Chesapeake; though Baltimore could still be covered in time, for a vessel would arrive off the harbor before one which had entered at the capes of Virginia. If, however, the defense of the two bays be alone considered, and a rendezvous at Liston's Point for the Sassafras line be compared with the Breakwater rendezvous for the Choptank line, an equality to within about one-quarter of an hour would be established for arrival in the Chesapeake off the mouth of the Choptank, and this little would be in favor of the Sassafras line.

Considering the defense of the two bays alone, it would be sufficient in the case of the Sassafras line if the defense could concentrate at Liston's Point before a hostile vessel entering at the Delaware capes could reach that point. The defending vessels could then be near the western extremity of the Sassafras line, at some point within the estuary, and would then be in a position to gain several hours in moving to the defense of the lower Chesapeake over a force stationed at the Delaware Breakwater and moving via the Choptank. For the purposes of concentration for the defense of the two bays the Sassafras is then superior to the Choptank in regard to rapidity. In this respect there is little or no difference between the Sassafras and the Back Creek lines.

For security of communication the Sassafras is superior to the Choptank, as the entire route from Baltimore to Philadelphia can be protected by shore defenses, and the defense can be made or assisted at any point by gun-vessels whose light draught would permit them to keep out of water in which they could be rammed by the sea-going war-ships. The Back Creek Route in this respect is precisely the same as the Sassafras.

The contingency of ice in its effect upon the movement of vessels is not here considered.

NOTES UPON THE ICE OBSTRUCTIONS ADDITIONAL TO FORMER REPORTS.

An abstract of certain ice records was compiled for the Delaware Bay for the winter of 1878–'79, and submitted July 6, 1882. This abstract is printed in the Annual Report of the Chief of Engineers for 1882, page 959.

An analysis of the abstract for the lower portion of the Delaware Bay for the winter of 1878–'79 seems to show as follows in general terms:

There was no ice to obstruct, either in the bay below Reedy Island or in the breakwater harbor, up to and including January 1, 1879.

January 2, 3, and 4, 1879.—There is no record for the bay proper. In the breakwater harbor ice begins to form, and extensive fields apparently of no great firmness float about with the tide. And on January 5, the breakwater harbor being as stated, there was very heavy ice in the bay above the Cross Ledge, which is about 23 miles below the débouché of the Sassafras Canal.

January 6, 1879.—Ice in Delaware Bay blocking the channel in places below Bombay Hook, and above Bombay Hook to Reedy Island, from shore to shore, with very little water space, the ice averaging 6 to 9 inches thick. After this date, to include January 8, there is no record for the bay below the Sassafras. In this interval (January 6, 7, and 8) there was much ice in the breakwater harbor, which broke up and drifted away on the night of the 8th, leaving the harbor clear on the 9th, on which date there was very little ice in the bay, though large quantities outside the capes.

January 10, 11, *and* 12, 1879.—There was no ice in the breakwater harbor; no records are known of the ice in the bay; on the 10th and 11th, though, I infer from the Fort Delaware and Finn's Point records that it was not serious, but on the 12th the ice was heavy in fields from Reedy Island down to Cross Ledge.

January 13 *to January* 21, *inclusive.*—There was much ice in the breakwater harbor each day, in greater part brought in and moved about by the tides. None of this seems to have been formed in place, though on the 15th, 16th, and 17th there was some packed along the shore, out to the pier heads, as on the 15th, and again 200 feet in width as on the 16th. On 13th, 14th, 16th, 18th, and 21st there are no records for the bay, and on the 20th only that it appeared from the breakwater harbor as comparatively free of it. On the remaining three days of this time we have the following reports:

On the 15th, from Brown's Shoals up, bay full of ice; on 17th, a vessel going out had no detention, reporting bay clear of ice; and on 19th very little ice in bay. The bay we regard here as below Reedy Island. The indications of these reports are that, for this interval of nine days, there was more ice proportionally in the breakwater harbor than in the bay.

From this time on no more ice was observed in the breakwater harbor; the total time, then, in which ice was here observed was about three weeks. For about a month afterward, to include February 24, there was generally more or less ice in the bay, but there seems to have been comparatively little detention from that cause if we except perhaps five days, January 23, 24, and 25, February 20 and 22, and for about one-third of the time there was practically none at all.

To sum up the Delaware records for this season, it may be stated that there would be more inconvenience from ice in the Sassafras approach up the bay than in the Choptank approach through the breakwater harbor.

It is to be regretted that records for the Delaware Bay are not available for the season of 1880–'81, as this was an exceptionably severe one. The following letter gives a summary of the condition of the breakwater harbor during this season:

UNITED STATES PIER, NEAR LEWES, DEL.,
March 15, 1881.

SIR: I have the honor to render herewith a report upon the appearance and condition of the ice in the harbor of the Delaware Breakwater and vicinity during the past winter, 1880–'81.

The first slush-ice had formed during the night of December 10, and extended for a width of 300 feet along the shore, the piles of the pier remaining covered up to high-water mark with a thick coat of ice during low water the next morning. This ice projected further into and up the harbor the following day, but disappeared during the night of December 12, on the ebbtide, a strong southwest wind driving it to sea.

New ice began to form rapidly at the beginning of the cold spell that set in shortly after Christmas, and on December 30 the harbor was full of drifting slush-ice, extending to the breakwater and beyond. The ice inshore of the bar, all along the shore, became packed, and did not move until January 4, when it broke loose, a westerly wind setting it off-shore.

Notwithstanding the fact that the temperature remained comparatively mild until January 8, great quantities of floating ice-fields passed through the harbor on the ebb and flood tides.

Subsequently the temperature remained below freezing, and slush-ice commenced to form along the shores, packing to such an extent upon the bar the next day that the flow of the tides did not affect it, no movement being perceptible. Large fields of ice of a slushy nature, however, continued to pass through the harbor until January 21, when a heavy rain and westerly gale melted it all or drove it off-shore, and no ice was visible in the harbor or bay on January 22.

January 27, slush-ice was again observed along the shore. The temperature continued to remain below the freezing point from that day until February 5, falling on several days to only a few degrees above zero. During that period the formation of ice assumed proportions seldom observed in this region. Huge cakes of Delaware River ice, easily distinguishable from salt-water ice, that had floated into the harbor during the previous week were cemented together, as it were, by new ice, forming large fields extending out to the channel of the bay, and becoming so solid finally that on February 2 a few sailors walked across it in a direction from the breakwater to the shoals near the cape, a feat accomplished subsequently in all directions across the harbor by many persons up to February 8, when the temperature became milder and the ice began to move again with the tide in the vicinity of the point of the cape.

The thickness of the ice-cakes did, probably, not exceed 15 inches; but as nearly all of them had frozen together in a slanting position, lapping each other, more or less, it is possible that the mass of ice in some places may have exceeded this size during the coldest days.

The break-up, which took place gradually after February 9, was not combined with any casualties to the shipping or works in the harbor, a fact greatly due to the then prevailing calm weather and light southerly winds. Otherwise, the results might have been different.

Two ships. one bark, and a light vessel having anchored near and outside the breakwater and icebreaker when the severe freezing commenced, broke their moorings on the first pressure of the ice and were carried near, and two of them partly upon, the stone work, where they remained several days until towed away. A brig and two schooners anchored inside the harbor dragged their anchors under the same circumstances, and got into dangerous proximity to the point of the cape from where they drifted away unhurt at the breaking up of the ice. About forty vessels were fast in the ice at this time, none of them sustaining any material damage.

A better idea of the solidity of the ice during those days may be formed from the fact that city ice-boat No. 3 on February 4, p. m., consumed four hours in breaking her way towards "the Gap" from the railroad pier where she had arrived the previous night. Two days later city ice-boat No. 2 spent nearly as much time to make half that distance to get near No. 3, then lying in the middle of the harbor, to replenish her with coal. The Old Dominion steamer Breakwater, unable to make harbor and to break through the ice when near the cape, on Friday, February 4, had to return to New York.

After the ice had begun to move all over the bay during the night of February 9, the warmer temperature made it disappear rapidly, and the harbor was free of ice again February 14, since which date, on two or three occasions, slush-ice in small quantites has been observed along the shore after a particularly cold night, the last time on the 2d of this month. * * *

Very respectfully, your obedient servant,

A. STIERLE,
Assistant Engineer.

Capt. WM. LUDLOW,
Corps of Engineers, Bvt. Lieut. Col., U. S. A.

Ice-records compiled from the log-book of the Baltimore City ice-boat by permission of Mr. N. H. Hutton, engineer of the Harbor Board of Baltimore, for the winters of 1878–'79 and 1880–'81, are printed in the Annual Report of the Chief of Engineers for 1882, page 959, with those

for the Delaware Bay, referred to above. These records refer to the services of the ice-boat in keeping open the approaches to Baltimore Harbor through the channels now provided. As noted in a former report the new cut-off now being excavated will most probably decrease the obstructions from ice when approaching from below.

For the Chesapeake Bay above the present approaches to Baltimore no records of the actual difficulties to be encountered by navigation during movements of ice are available if we except those from the Baltimore City ice-boat (February 16, 17, and 18, 1881). We only know for a number of years the time lost by a regular line of steamers in each winter season. This gives us no absolute standard, however; with a larger trade and more powerful steamers, and a canal line at tide-level in which "repairs" would not enter as an element of detention, the time lost would be decreased in proportion. Now for all lines trading from Baltimore to points across the bay, the winter trade is light, and the steamers are not built to contend with ice which would present a serious obstacle to the commerce of this port.

In this connection I will take occasion to say that Mr. H. V. Lesley, secretary to the company owning and operating the present canal, by letter to me dated February 8, objected to the statement in my report of February 3, 1882, of a steamer being detained the "whole season" from proceeding through the Chesapeake to Baltimore, and that the officers of the Ericsson line stated it was not true. The statement, as related in my report, was made in my hearing by a pilot of one of their steamers to another employé of the boat; in the year (1877) which I remember as the year alluded to by the pilot, the steamers were detained thirty-six days according to the officials of the Ericsson line (see Report of Chief of Engineers, 1880, page 734), and by letter of Mr. Lesley, December 2, 1881 (see Report of Chief of Engineers, 1882, page 955), the canal was not navigated for forty days in that year.

In general terms there can be no question that the obstruction by ice via a northern route would be greater than that met with if the southern route were used.

The experience of the ice-boat in working up on the Baltimore approaches shows that the moving fields and not the ice in place make the most trouble. These fields undoubtedly come mostly from the upper bay and the Susquehanna.

With sea-going vessels it is probable that on one-third or more of the winters there would be no trouble to speak of on the Chesapeake.

We have not the data by which we can measure the value of the average detention to which vessels would be subjected if compelled to take either of the routes. From the records at hand, I am of the opinion that vessels in severe seasons would not, if in doubt as to the condition of the passage throughout, attempt the transit of the upper Chesapeake and Delaware, but would run for the Virginia capes at once. Inward-bound vessels would do this to a greater extent than those outward bound. This is true in a lesser degree in the case of the southern route. It will be remembered that in passing from Howell's Point down a vessel of greater draught than 24 feet will have two reaches of dredged channel to pass through in the open bay, which, as shown in a previous report, is a serious thing to attempt when fields of ice are drifting over the cuts. A vessel drawing more than 21 feet, and less than 24, will have one such reach, the longer, to pass through.

If a northern route be chosen I think it would be unnecessary and perhaps inadvisable to open the Brewerton Channel eastward of the new cut-off at the outset, but to use this cut-off for all deep-draught vessels until experience demonstrated the inadvisability of a change. I

would then have no fears of any serious shoaling up to the mouth of the Sassafras and Elk rivers; the recent surveys compared with former ones show this.

COST OF MAINTENANCE.

The maintenance of the route when completed will consist of—

1st. Breaking ice.

2d. Dredging to maintain the proper depth and width throughout, from Baltimore to the sea.

3d. Maneuvering the tide-locks.

4th. Lighting the canal.

5th. Expenses of superintendence and supervision.

BREAKING ICE.

This it must be remembered cannot be counted on as removing the obstruction by ice; the practicable end is to render transit during ice seasons reasonably sure, though more tedious and subject to damage. It will be assumed, too, that at the outset the Brewerton Channel will not be opened to the bay.

After careful consideration I arrive at the following conclusion as giving facilities about equal to those now afforded, in seasons of ice, in the present approaches to Baltimore: For the Choptank Route, one ice-boat; for the Sassafras Route, two ice-boats; for the Back Creek Route, three ice-boats. I do not wish to state absolutely that this provision would place the three routes upon an equality. It is my opinion that the Choptank would still offer the least obstruction, the Back Creek Route next in order, and the Sassafras last. I only desire to state that if either of the routes were chosen that I would in the beginning limit my recommendation to the construction of the number of ice-boats given. The cost of one ice-boat would be about as follows:

One ice-boat, building of		$140,000
Ten per cent. for repairs and rebuilding		14,000
Which for three years would be	$42,000	
Expenses of crew, fuel, &c., for three years	18,000	
Total expenses for three years	60,000	

Average cost per year, $20,000 for each boat.

DREDGING.

After the work was completed, I believe that one or two dredges of good capacity would be sufficient for either of the lines, and I am of opinion that the amount of dredging necessary would be greatest on the Choptank and least on the Sassafras.

The cost of each dredge per year is estimated to be $20,000, to cover repairs, sinking fund for renewal of plant, tug and scows, and all running expenses.

MANEUVERING LOCKS.

The lock-gates should be operated by steam-power, and both day and night crews should be provided. The force necessary would be as follows:

One chief keeper, per month	$75
One assistant keeper, per month	60
Two engine-drivers per month, $60 each	120
Six hands to catch and throw off lines, at $40 each per month	240
Fuel, light, &c., per month	10
Maneuvering, per month	505
Or per year	6,060
To which should be added for coal	500
Making total for one year	6,560

LIGHTING CANAL BY ELECTRICITY.

BACK CREEK ROUTE.

First cost of plant	$35,000
Allowing 10 per cent. for repairs and renewal, this sum will correspond to, per year	3,500
Coal, per year	3,000
Carbons, per year	3,200
Engine-drivers and firemen, per year	2,880
Trimmers, per year	1,440
Total, per year, for lighting 18 miles	14,020

SASSAFRAS LINE.

First cost of plant	$55,000
Which will correspond, per year, to	5,500
Coal, per year	4,500
Carbons, per year	4,800
Engine-drivers and firemen, per year	4,320
Trimmers, per year	2,400
Total, per year, for lighting 30 miles	21,520

CHOPTANK LINE.

First cost of plant	$87,000
Which will correspond, per year, to	8,700
Coal, per year	6,000
Carbons, per year	8,000
Engine-drivers and firemen, per year	5,760
Trimmers	3,840
Total, per year, for lighting 50 miles	32,300

It is assumed that one lamp at each quarter of a mile would answer.

The cost of maintenance of each line may, then, be recapitulated as follows:

BACK CREEK ROUTE.

Breaking ice, per year, three ice-boats	$60,000
Dredging, per year, two dredges	40,000
Maneuvering tide-lock, per year	6,560
Lighting canal, per year	14,020
Expense of supervision, per year	3,000
Total for maintenance, per year	123,580

SASSAFRAS ROUTE.

Breaking ice, per year, two ice-boats	$40,000
Dredging, per year, two dredges	40,000
Maneuvering tide-lock, per year	6,560
Lighting canal, per year	21,520
Expenses of supervision, per year	3,000
Total for maintenance, per year	111,080

CHOPTANK ROUTE.

Breaking ice, per year, one ice-boat	$20,000
Dredging, per year, two dredges	40,000
Maneuvering tide-locks, per year	19,680
Lighting canal, per year	32,300
Expenses of supervision, per year	3,000
Total for maintenance, per year	114,980

If the opening of the Brewerton Channel be considered as needed for a northern route, there should, in my opinion, be added to the costs of maintenance for the Back Creek and Sassafras routes the cost of one ice-boat and one dredge; that is, $40,000 per year.

All of which is respectfully submitted.

THOMAS TURTLE,
Captain of Engineers.

Lieut. Col. WM. P. CRAIGHILL,
Corps of Engineers, U. S. A.

REPORT OF LIEUTENANT-COLONEL WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS, OF DECEMBER 5, 1882.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., December 5, 1882.

GENERAL: The river and harbor act of August 2, 1882, contained the following clause:

* * * The sum of ten thousand dollars, or so much thereof as may be necessary, be, and the same is hereby, appropriated, to be expended under the direction of the Secretary of War in completing the surveys of a ship-canal to connect the Chesapeake and Delaware bays, and the Secretary of War is hereby directed to report to Congress which of the various routes surveyed will afford the greatest protection in case of war, and the greatest facilities to commerce by cheapening the cost of transportation from the city of Baltimore to the Atlantic Ocean, together with the cost of said improvement and its approaches, and the annual cost of maintaining and operating said canal when constructed: *Provided*, That nothing herein shall be construed to commit the Government to proceed with the construction of the said improvement.

The surveys were taken in hand soon after, under the immediate direction of Capt. Thomas Turtle, Corps of Engineers, who, during my absence in September and October, on other duty, had charge of this and other works in this section.

The most important feature of the additional surveys has been some borings of greater depth than hitherto made. Their results, and those of others now in progress, should have a very important bearing on the question as to which the Secretary of War is called upon to report to Congress under the paragraph quoted above.

While the maps are not quite finished, they can, if necessary, be in a very short time put in a condition to be used as well as if entirely completed.

The subject of the advantages and disadvantages of the several routes has been already reported on from this office more than once in obedience to instructions. In view of the statements in the letter of Mr. Norvin Green to the honorable Secretary of War, dated September 16, 1882, as to which Captain Turtle made a report dated September 28, 1882, I venture to suggest that it might be well to bring the whole subject before a special commission.

The main objects of such a canal are supposed to be two: the greater facilitation of the defense of a part of the territory of the United States by the opening of an interior short line of communication between the great bays, Chesapeake and Delaware, and the shortening of a great route of foreign and coastwise commerce. Both of these objects seem to be of national importance.

The city of Baltimore is greatly interested in this canal. She is nearer the great cities of the West, Chicago, Saint Louis, Cincinnati, and others, than Philadelphia, New York, and Boston, her great contestants for the trade of the West; but her situation at the head of Chesapeake Bay

requires her commerce to take a longer route to the ocean than is convenient; that is, through the whole length of that bay.

Baltimore, therefore, very naturally is extremely anxious to be brought nearer in time to the ocean; to this she is pressed not only by her own interest, but also by the interests of the large territories which make her the outlet to foreign and coastwise markets for their products. Baltimore can be brought many miles nearer to the ocean by the construction of a canal connecting the Chesapeake and Delaware bays.

If the suggestion be adopted as to the formation of a commission to consider the several routes, it is recommended that its composition be as follows:

1. One officer of the Army of high rank, not of the Corps of Engineers.
2. One officer of the Navy of high rank.
3. One officer of the Corps of Engineers.
4. One civilian to be appointed from Baltimore to represent the interests centered in this city.
5. One civilian from the northern half of the Mississippi Valley, to represent the interests therein having Baltimore as their Atlantic port.

While I would, of course, expect to appear before such a commission to give any information I might have on the subject, I would greatly prefer not to be a member of it.

Captain Turtle, Corps of Engineers, who has had much to do with the surveys of the several routes, might very appropriately be appointed recorder to the commission without a vote.

Very respectfully, your obedient servant,

WM. P. CRAIGHILL,
Lieut. Col. of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

REPORT OF LIEUTENANT-COLONEL WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS, OF DECEMBER 20, 1882.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., December 20, 1882.

GENERAL: Much interest is exhibited here as to the results of the last surveys for a canal between Chesapeake and Delaware bays, and it seems expedient for me to make another brief communication on the subject, inviting attention again to my letter of December 5, 1882.

The maps are not yet finished, but they could be used intelligently by those who were making a study of the subject, and it is one which requires study on the part of experts. In my judgment it is not altogether a question to be decided from the standpoint of the engineer. For this reason I suggested its consideration by a mixed commission. I feel quite sure the honorable Secretary of War has not the time to study the details of this problem, and I would greatly prefer he should be advised by such a commission as has been recommended, or, perhaps, by some other of a different composition, rather than hear only my opinion.

The borings referred to in my letter of December 5 will be completed early in January, 1883. These additional and deeper borings were considered necessary because of the increased depth of the channel to Baltimore from 24 to 27 feet, now being given under the direct authority of Congress, and it was supposed the ship-canal between the two bays should conform thereto.

Should such a commission as has been suggested be organized, there is ample material now ready to engage their attention. The borings would be ready by the time they were ready for them.

Very respectfully, your obedient servant,

WM. P. CRAIGHILL.
Lieut. Col. of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

LETTER OF DR. NORVIN GREEN TO THE HONORABLE THE SECRETARY OF WAR.

EXECUTIVE OFFICE, WESTERN UNION TELEGRAPH COMPANY,
New York, September 16, 1882.

DEAR SIR: My attention has been called to a further appropriation of $10,000 in the river and harbor act for continuing the surveys of a canal to connect with the Chesapeake and Delaware bays. I beg you will allow me to lay before you the facts in relation to that improvement, as I understand them.

A few years ago the Maryland and Delaware Ship-Canal Company was incorporated by the States of Maryland and Delaware, and that company has made its surveys and secured the right of way on the Sassafras Route. At that time Mr. John W. Garrett, of the Baltimore and Ohio Railroad interests, and the general sentiment of the city of Baltimore, warmly supported this organization. During the last two years the Baltimore and Ohio interest has determined to press the Government to build a free canal, and the mercantile interests of the city of Baltimore have followed in the wake. They have, consequently, directed the Government surveys to what is known as the Choptank Route, requiring a canal of 37 miles in length, and costing $16,000,000, as against the Sassafras Route, belonging to the Delaware and Maryland Company, requiring a canal of 16 miles and costing $8,000,000, both by Government surveys. These surveys have been very thoroughly made by the Government again and again, and the figures I give you are from the report of Government engineers. There is really no earthly need to make any further surveys, and the only object in putting that in the appropriation bill was to keep the subject alive and to keep up the appearance that Congress was going to build a free canal, in order to dampen and deter the private enterprise.

I am largely interested in the Maryland and Delaware Ship-Canal Company, owning the franchise for the Sassafras Route, and we should have been able to put our canal under contract and had it well-nigh completed by this time but for the agitation of the Government canal.

If further surveys must be made, I respectfully ask that due attention be paid to the Sassafras Route, and a special examination of the feasibility of the inlet and outlet of the Choptank Route, which expert seamen have very generally pronounced impracticable.

I have the honor to be, respectfully and truly, yours,

NORVIN GREEN.

Hon. ROBERT T. LINCOLN,
Secretary of War.

P. S.—This will be handed you by my friend Mr. Horace B. Tebbetts, the president of the Maryland and Delaware Ship-Canal Company.

Truly yours,

N. GREEN.

[First indorsement.]

WAR DEPARTMENT,
September 21, 1882.

Respectfully referred to the Chief of Engineers, inviting his attention to the suggestions of Dr. Green.

ROBERT T. LINCOLN,
Secretary of War.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
September 26, 1882.

Respectfully referred to Captain Thomas Turtle, Corps of Engineers, for his information and for remark, attention being called to the foregoing indorsement of the Secretary of War.

To be returned.

By command of Brigadier General Wright:

JOHN G. PARKE,
Lieut. Col. of Engineers,
Bvt. Maj. Gen., U. S. A.

[Third indorsement.]

UNITED STATES ENGINEER OFFICE,
Baltimore, September 28, 1882.

Respectfully returned to the Chief of Engineers, with a separate report of this date.

THOMAS TURTLE,
Captain of Engineers.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
October 4, 1882.

Respectfully returned to the honorable, the Secretary of War, with report of Capt. Thos. Turtle, Corps of Engineers, to whom it was referred, and to which attention is invited. It is believed that Captain Turtle's statement will fully show the necessity for the further survey against which Dr. Norvin Green protests.

H. G. WRIGHT,
Chief of Engineers,
Brig. & Bvt. Maj. Genl.

LETTER OF CAPTAIN THOMAS TURTLE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., September 28, 1882.

GENERAL: I have to acknowledge the receipt of a letter dated September 16, 1882, from Dr. Norvin Green to the honorable the Secretary of War in reference to further appropriation of $10,000 in river and harbor act for surveys of canal route to connect Chesapeake and Delaware bays, which was referred to me as per indorsement in your office of September 26, 1882, for my information and remark, my attention

being called to the indorsement thereon of the Secretary of War inviting attention to the suggestions of Dr. Green.

Dr. Green states that certain interests named by him "have directed the Government surveys to what is known as the Choptank Route." The unfairness of this statement calls for a brief history.

The first appropriation for surveys was made June 18, 1878, and Major (now Lieutenant-Colonel) Craighill was placed in charge. In the first report rendered by him (February 7, 1879, see Report Chief of Engineers, 1879, Part I, page 588), he states that—

> Severe weather came on before all the information desired had been obtained * * * that the information at our disposal is, however, sufficient to justify the preparation of comparative approximate estimates of cost for three routes, the most northern, the most southern proposed, and the most direct intermediate one. Several other routes have been surveyed.

The "most northern" was the "Sassafras"; the "most southern proposed" was the "Choptank," and "the most direct intermediate one" was the "Queenstown Line." The estimates are given in the report referred to, and those for the "Sassafras" were based upon the details furnished by Mr. Latrobe, who, I believe, was consulting engineer for the Maryland and Delaware Canal Company. In Major Craighill's next report (November 18, 1879, see Report Chief of Engineers, 1880, Part I, page 713), made after fuller information, the estimates for these three routes were revised, and estimates were given of the cost of three other routes. The estimates of the Sassafras Route were still based upon the data furnished by Mr. Latrobe. In the words of the report:

> The Sassafras Route was not surveyed, because the funds available became exhausted and because there were in existence a project and estimate for it by Mr. Latrobe, already referred to. * * * As it has lately become practicable to survey that route also, parties are now in the field upon it. A supplemental report will be shortly made containing the results of their work.

Accordingly Major Craighill rendered such supplemental report with maps and estimates, January 8, 1880. (See Report of Chief of Engineers, 1880, Part I, page 735.)

The next surveys were made in 1881 (my first connection with the work), Major Craighill being still in charge. The surveys made were recommended by me, and consisted of examinations at the inlet and outlet of the Choptank Route, of the bay approaches to the Sassafras Route, and of a survey of still another route, that *via* the present canal. A preliminary report was made (Senate Ex. Doc. No. 99, Forty-seventh Congress, first session), and estimates were forwarded with annual report of fiscal year just closed. The surveys, then, have not been directed to any particular route by any interest whatever.

With reference to the suggestion of Dr. Green, that "there is really no earthly need to make any further surveys," the following is pertinent:

I was requested by Lieutenant-Colonel Craighill to submit a project for the expenditure of the present appropriation of $10,000 for surveys. I stated in a letter to him August 14, 1882, that—

> There is no doubt that for the locations proposed for the Back Creek, Sassafras, and Choptank routes the surveys already made supply all data needed for a comparative estimate of the cost of these routes with any given dimensions and any assumed declivity of side slopes.

I recommended that the maps and notes of the former surveys be completed, that some missing information be supplied, and that (the chief point of my recommendation) a more extended investigation be

made of the material to be cut through in the upper part of the peninsula, and I stated that—

> The borings should, in my opinion, precede all further examination, and the decision of such further examination should be deferred till the borings are made and studied.

Lieutenant-Colonel Craighill, in his project, submitted to the Chief of Engineers, dated August 16, 1882, recommended the completion of the maps; that the missing information be obtained (running a line of test levels, with a re-examination of some work of Back Creek and at the mouth of the Sassafras), and that borings be made on the upper part of the peninsula. This project was approved by the Chief of Engineers, and the work is now under way.

At the earliest day practicable the results will be reported, that the Secretary of War may determine upon those points so specially assigned to his consideration by the terms of the act. I feel assured that the honorable Secretary will find, when the results are laid before him, that no unnecessary work has been done.

Very respectfully, your obedient servant,

THOMAS TURTLE,
Captain of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

LETTER OF LIEUTENANT-COLONEL WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., April 10, 1883.

GENERAL: On the 2d of April I received a copy of the inclosed printed letter dated March 5, 1883, from Mr. G. M. Totten to Mr. Horace B. Tebbetts, president of the Maryland and Delaware Ship-Canal Company, accompanied by the inclosed printed paper, entitled Specifications.

April 2 I wrote a letter to Mr. Tebbetts, asking for certain information, of which a copy is herewith.

I have had no reply to the letter, but have received several copies of two printed papers, copies of which are herewith, one being a letter dated July 24, 1882, from Mr. G. M. Totten to Mr. H. B. Tebbetts, and the other being a printed specification of larger dimensions than the previous one.

As bearing upon this subject I send herewith also an article written by an evidently critical member of the staff of the *Sun* of this city. It appeared in the issue of that paper of April 7.

It is suggested that these papers be placed with others on the same subject from time to time sent from this office, if it comes up for consideration again with a view to a selection of a route for the canal to connect the Chesapeake and Delaware bays.

Very respectfully, your obedient servant,

WM. P. CRAIGHILL,
Lieut. Col. of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

LETTER OF THE CHIEF ENGINEER TO THE PRESIDENT OF THE MARYLAND AND DELAWARE SHIP-CANAL COMPANY.

NEW YORK, *March* 5, 1883.

SIR: The estimates of the costs of the Maryland and Delaware Ship-Canal, contained in my report to you of July 24, 1882, were based upon the assumption as

therein stated, that "as 21 feet is the greatest depth of water that can be carried into the port of Baltimore, this may be assumed as the proper depth of water for the canal." It is now known that the work of deepening the channel leading to the port of Baltimore has been commenced, in reference to which the following is an extract from the last annual report of the president and directors of the Baltimore and Ohio Railroad Company:

"The work of deepening the channel to the port of Baltimore to 27 feet at mean low water has progressed satisfactorily. Under the contract with the American Dredging Company, which was mentioned in the last annual report, 1,000,000 cubic yards have been removed. Another contract has been made with the National Dredging Company for the removal of 2,500,000 cubic yards from the Fort McHenry, Brewerton, and Craighill channels, and three dredges are now at work. Of the $900,000 stated in the last annual report as the estimate of the engineer in charge, Colonel Craighill, as necessary for the completion of the work, $450,000 were appropriated by Congress by act approved August 2, 1882, River and Harbor Bill. It is expected Congress will promptly appropriate the remaining $450,000 required to complete this work, so important in its economic bearings to the consumers and producers of thirty-seven States and Territories which so largely use Baltimore as their best port for foreign trade."

It is evident that, in order to command the trade of Baltimore, the canal must have a depth of water equal to that of the channel in the bay; hence a new estimate of the cost of the work must be made corresponding to this increased depth.

The former estimates were made upon the plan of constructing the canal proposed by Mr. Latrobe (see his report), which included giving the sides of the canal a slope of one to one (45°) for a distance of 19,700 feet of the deepest cutting; walling the sides below the berme for this distance, and building 13,800 feet of platform supported on piles to answer as berme where the cutting is less.

I propose to omit the walling and pile platform, to make regular bermes the whole length of the canal, on each side, from 9 to 12 feet in width, depending upon the depth of the cutting 5 feet above low-water level; and to give the sides of the cuts a slope of one and a half to one below the bermes and one to one above. The depth of the water to be 27 feet below mean low-tide level, and the width of the canal at the bottom to be 90 feet.

On this plan and with these dimensions the estimated cost, as given below, is $6,575,303.75. (On Mr. Latrobe's plan the cost would be $7,108,651.)

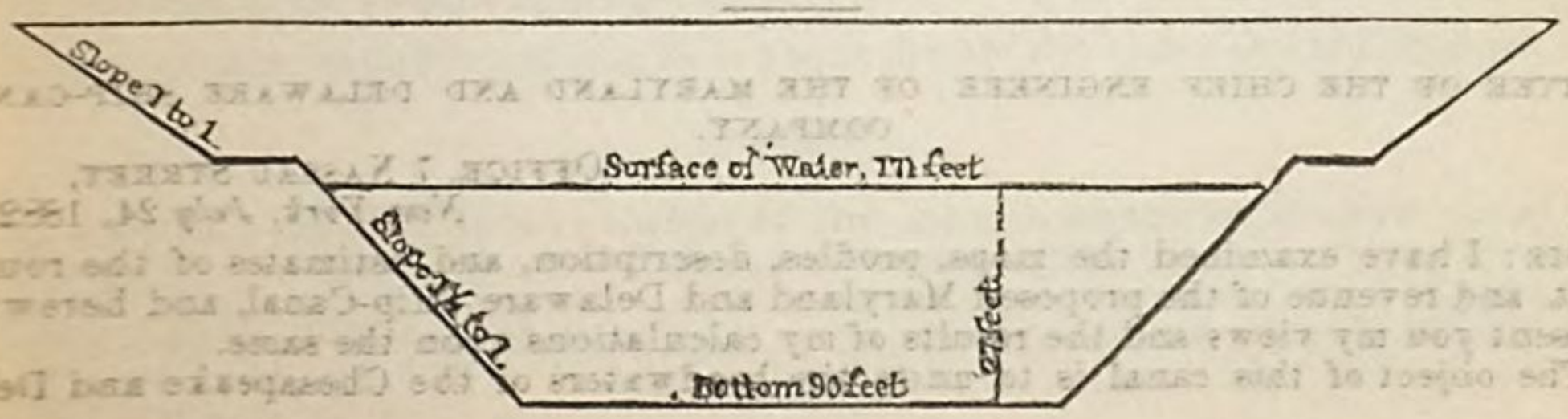
ESTIMATE OF THE COST OF THE MARYLAND AND DELAWARE SHIP-CANAL.

Excavation below low water, 10,977,678 cubic yards, at 12½ cents	$1,372,209 75
Excavation between high and low water, 2,145,584 cubic yards, at 15 cents	326,857 60
Excavation above high water, 16,973,775 cubic yards, at 20 cents	3,394,755 00
Dredging channel of Sassafras River, 2,000,000 cubic yards, at 12½ cents.	250,000 00
Concrete covering for bermes, 12 foot thick, 13,246 cubic yards, at $4	52,984 00
Estimated cost of canal proper	5,391,806 35
Right of way land, 1,860 acres	144,000 00
Approaches and bridges, as per estimate of Mr. Latrobe	335,000 00
	5,870,806 35
Engineering, superintendence, and contingencies	704,496 83
Total estimated cost	6,575,303 18

Very respectfully,

G. M. TOTTEN.

HORACE B. TEBBETTS, Esq.,
President of the Maryland and Delaware Ship-Canal Company.



THE MARYLAND AND DELAWARE SHIP-CANAL.

SPECIFICATION.

The line of this canal will commence at Georgetown Bridge, on the Sassafras River, and will occupy the bed of that river, excepting for a short distance, to George Kennedy's mill-dam, a distance of 4 miles; thence it will follow the main tributary, keeping the general course of the valley to the summit or divide between the waters that flow into the Chesapeake and Delaware bays. From the divide, where the waters of the Blackbird Creek take their rise, the line will follow the valley of a branch of this creek to near the crossing of the Delaware Railroad Bridge over the Blackbird Creek and valley; thence it will follow this creek and valley to a point near Taylor's Bridge; and thence, leaving the creek and valley, it will take nearly a direct course to a large cove on the Delaware Bay just below Gull Bar and Liston Point.

The total length of the line of the canal from Georgetown Bridge to the terminus on Delaware Bay is 20 miles.

The width of the canal shall be 90 feet at the bottom, excepting the 4 miles between Georgetown Bridge and Kennedy's dam, which shall be dredged to a width of 150 feet, with perpendicular sides, or its equivalent.

The depth of the canal shall be 27 feet below mean low tide at Georgetown Bridge.

There shall be a berme on each side of the canal from 9 to 12 feet in width, according to the depth of the cuttings, at a height of 32 feet above the level of the bottom of the canal.

The sides of the canal and cuttings shall have slopes of 1½ feet to 1 foot below the bermes, and of 1 foot to 1 foot above the bermes, so that there will be at the surface of water in that part of the canal east of Kennedy's dam a width of 171 feet at mean low tide.

The surface of the bermes shall have a covering of concrete one-half foot in thickness.

The bridging on the canal will consist of two railway and nine highway or wagon-road bridges, and a draw at Georgetown Bridge.

All the abutments and piers to be of stone and iron. The superstructures are to be of iron, and every bridge is to have a draw opening 100 feet.

All the material and workmanship must be of the best kind.

LETTER OF LIEUTENANT-COLONEL WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS, TO THE PRESIDENT OF THE MARYLAND AND DELAWARE SHIP-CANAL COMPANY.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., April 2, 1883.

DEAR SIR: Some one has sent me a copy of a printed letter to you, dated March 5, from Mr. G. M. Totten, containing a revised estimate of the cost of the proposed Maryland and Delaware Ship-Canal, and inclosing a printed specification.

Will you have the kindness to send me several more copies, if you have them to spare?

In the heading "Approaches and bridges," would he object to separating the two items and letting me know the estimated amount for each, in order to a comparison with estimates lately made here? I will send you copies of the estimates here when they are printed. It is supposed he will include under the term "approaches" the excavations in Chesapeake Bay and its tributaries, up to Georgetown Bridge, and in the Delaware and its tributaries, to obtain a depth of 27 feet at low water from the ends of the canal proper. A canal without such connections would be of little use to heavy ships.

Respectfully yours,

WM. P. CRAIGHILL,
Lieut. Col. of Engineers.

Mr. HORACE B. TEBBETTS,
New York, N. Y.

LETTER OF THE CHIEF ENGINEER OF THE MARYLAND AND DELAWARE SHIP-CANAL COMPANY.

OFFICE, 7 NASSAU STREET,
New York, July 24, 1882.

SIR: I have examined the maps, profiles, description, and estimates of the route, cost, and revenue of the proposed Maryland and Delaware Ship-Canal, and herewith present you my views and the results of my calculations upon the same.

The object of this canal is to unite the headwaters of the Chesapeake and Dela-

ware bays by means of an internal water communication between them, and thus to save a long distance, mostly of coast navigation, between Baltimore and the ports east thereof, as well as those of Europe.

The route selected as the most favorable for this purpose extends from the mouth of Sassafras River, on Chesapeake Bay, to Liston Point, on Delaware Bay. Sassafras River enters into Chesapeake Bay on its eastern shore, about 30 miles east of Baltimore, and Liston Point is on the west shore of Delaware Bay, not far below the mouth of Blackbird Creek, and 35 miles north of Cape Henlopen.

This route was located by General William Cullen Brown, and was subsequently examined and reported upon by the late Benjamin H. Latrobe as consulting engineer. It has also been examined and reported upon by Maj. William P. Craighill, United States Engineer, under an appropriation to that effect by Congress.

The distance from bay to bay by the line selected is 32.4 miles, which it is thought may be reduced to 30 miles by improving the Sassafras River, making 10 miles of deep river navigation from its mouth to Georgetown Bridge, 4 miles of dredging to deepen the river between Georgetown Bridge and the headwaters at Kennedy's Mill-dam, and thence 16 miles of through cut to Liston Point.

The distance saved by this canal will be 215 miles between Baltimore and New York, Eastern and European ports, and 286 miles between Baltimore and Philadelphia.

Mr. Latrobe gives estimates of the cost of the canal at various depths and widths, the only one of which that concerns us at present is on the supposition of 21 feet depth of water, 90 feet width of bottom, and 153 width of water surface, the cost of which he makes $10,454,064. Major Craighill proposes a canal having 26 feet depth of water, 100 feet width at bottom, and 178 feet width at water surface, the cost of which he makes $8,458,799.98.

It will be observed that the largest canal is estimated to cost the least. This comes from the different prices assumed for the work of excavation, Major Craighill's being the lowest.

As 21 feet is the greatest depth of water that can be carried into the port of Baltimore this may be assumed as the proper depth of water for the canal, although a greater depth would be preferable. The width of the canal should not be less than 90 feet at the bottom, which, with the slopes of the sides 1½ to 1, will give 153 feet at the water surface. With this width the largest class of vessels that can enter the port of Baltimore can pass each other freely. As it has been proposed to give the canal less width, I make estimates therefor, retaining the common depth of 21 feet for all. I adopt the prices assumed by Major Craighill for the excavation, as being more in conformity with the times than those assumed by Mr. Latrobe five years earlier, when prices were higher, and, especially, as the whole mass of excavation is favorable for the operation of machine excavators, in which great improvements have been made of late years. I take the result of my own calculations of the quantity of excavation, which is greater than that of Mr. Latrobe and smaller than that of Major Craighill, but for all incidental work I have adopted the figures of Mr. Latrobe.

My estimates of the cost of a canal with 21 feet depth of water are as follows:

For a width of 40 feet at bottom	$4,826,632
For a width of 70 feet at bottom	5,659,175
For a width of 90 feet at bottom	6,138,814

TONNAGE.

The tonnage of Baltimore is as follows for the fiscal year ending June 30, 1881:

Foreign, tons	2,842,468
Coastwise, entered	2,478,452
Coastwise, not entered, estimated	1,350,000
Total tonnage of Baltimore in 1881	6,670,920

The following table shows the increase of tonnage from 1872 to 1880:

		Tons.	
1872, entered	803 vessels, aggregating	354,645	
1876, entered	1,099 vessels, aggregating	672,656	Increase 89.6 per cent.
1880, entered	1,551 vessels, aggregating	1,326,991	Increase 97.2 per cent.

The aggregate tonnage out and in is about double the above inward tonnage.

RECEIPTS.

It is estimated that three-quarters of the gross tonnage of Baltimore will pass through the canal, which would give, for the year 1881, three-quarters of 6,670,920 tons, equal to 5,000,000 tons, which at 20 cents per ton—the price allowed to be charged for toll by the charters of Maryland and Delaware—would give $1,000,000 gross

receipts. But we will suppose that one-quarter of this tonnage will not bear a charge for toll of more than 10 cents per ton, then we shall have—

3,750,000 tons at 20 cents	$750,000
1,250,000 tons at 10 cents	125,000
Total receipts from the tonnage of 1881	875,000

As the canal will not be open for transportation before 1885, if the tonnage of Baltimore continues to increase at the same rate as it has done since 1876, it will then amount to 13,000,000 tons; but we will suppose that only half of this increase takes place in the current four years, making the total tonnage in 1885 about 10,000,000 tons, and that which goes through the canal 7,500,000 tons; then we should have—

5,600,000 tons at 20 cents	$1,120,000
1,900,000 tons at 10 cents	190,000
Total receipts for tonnage in 1885	1,310,000

ANNUAL EXPENSES.

Four tug-boats	$32,000
Dredging and repairs	15,000
Office expenses, including salaries	15,000
Sixteen drawbridge tenders, at $500	8,000
Breaking ice	5,000
Contingencies	20,000
Estimated expenses for trade of 1881	95,000
Increase of service in 1885	35,000
Annual expense in 1885	130,000

RECAPITULATION.

Cost	$6,140,000
Gross receipts	1,310,000
Annual expenses	130,000
Net receipts	1,180,000

Very respectfully,

G. M. TOTTEN,
Chief Engineer.

HORACE B. TEBBETTS, Esq.,
President of the Maryland and Delaware Ship-Canal Company.

THE MARYLAND AND DELAWARE SHIP-CANAL.

SPECIFICATION.

The line of this canal will commence at Georgetown Bridge, on the Sassafras River, and will occupy the bed of that river, excepting for a short distance, to Kennedy's Mill-dam, a distance of 4 miles; thence it will follow the main tributary, keeping the general course of the valley, to the summit or divide between the waters that flow into the Chesapeake and Delaware bays. From the divide, where the waters of Blackbird Creek take their rise, the line will follow the valley of a branch of this creek to near the crossing of the Delaware Railroad Bridge over the Blackbird Creek and valley; thence it will follow this creek and valley to a point near Taylor's Bridge, and thence, leaving the creek and valley, it will take nearly a direct course to a large cove on the Delaware Bay, just below Gull Bar and Liston Point.

The total length of the line of the canal, from Georgetown Bridge to the terminus on Delaware Bay, is 20 miles.

The width of the canal shall be 90 feet at the bottom, excepting the 4 miles between Georgetown Bridge and Kennedy's Mill-dam, which shall be dredged to the width of 150 feet, with perpendicular sides or its equivalent.

The depth of the canal shall be 27 feet below mean low-tide level at Georgetown Bridge.

There shall be a berme on each side of the canal, the width of which will be from 9 to 12 feet, according to the depth of the cutting, at a height of 32 feet above the level of the bottom of the canal.

The sides of the canal and cuttings shall have slopes 1½ feet to 1 foot vertical below the bermes, and 1 foot to 1 foot above the bermes, so that the width of the surface of

water in that part of the canal east of Kennedy's Dam shall be 171 feet at mean low tide.

The surface of the bermes shall have a covering of concrete one-half a foot in thickness, the said concrete to be composed of one part mortar (made as follows, namely, one part of fresh-ground hydraulic cement of the best quality and two parts of clean, sharp sand, entirely free from loam) and two and one-half parts of clean, sharp gravel or of clean stone, free from dust or dirt, and broken so as to pass in every way through a two-inch ring. It shall be quic·ly and thoroughly mixed in a box made for that purpose, and deposited in its place on the berme in a single layer the full thickness required, and may be settled into its place by slightly ramming, sufficiently to flush the mortar to its surface.

The following is a statement, based upon the estimates of the engineers, of the quantity and quality and the nature and extent, as near as possible, of the work required:

	Cubic yards.
Excavation below low water	10,977,678
Excavation between high and low water	2,145,584
Excavation above high water	16,973,775
Dredging channel of Sassafras River	2,000,000
Total amount of excavation	32,097,037
Concrete covering for bermes one-half foot thick	13,246

The above-mentioned quantities are believed to be thoroughly accurate, based upon the surveys and estimates of competent engineers, and are here stated to guide the contractor in his calculations as to the estimated cost of the excavations and dredging, and will also be used by the company as a basis of calculation in estimating the amount of work performed monthly by the contractor, in regulating the monthly payments.

The borings along the line of the canal, together with geological observations taken at several points upon the banks of the Sassafras and Blackbird creeks and their tributaries, indicate almost to a certainty the quality of the material to be excavated, which is as follows: gravel and sand above low water, and underlaid by strata of hard mud and clay, which again is underlaid by a deposit of marl, reaching far below the bottom of the proposed excavations.

The above proportions prevail along the entire line.

The bridging on the line will consist of two railway and nine highway or wagon-road brides, and a draw at Georgetown Bridge. All the abutments and piers are to be of stone and iron, the superstructures must be of iron, and every bridge is to have a draw opening 100 feet wide. All materials and workmanship must be of the best kind.

The railroad bridges will contain the following quantities of stone masonry and iron:

	Pounds.
Iron in superstructure	600,000
Iron in piers	90,000
Total amount of iron	690,000

Stone masonry in piers	cubic yards	1,500
Railroad at elevation	feet	54
Total length of bridge, about	do	360

The plans for the construction of these bridges will be drawn to agree with the above quantities. The above quantities given are only for one railroad bridge. It will be optional with the contractor to construct two bridges of the above proportions of materials, or by changing the route and grade of one of the railroads which cross the line of the proposed canal to make one bridge do for both the railroads.

The highway or wagon-road bridges will contain the following quantities of stone-masonry and iron, and no plan will be accepted by the company that does not conform with the said quantities:

	Pounds.
Iron in superstructure	330,000
Iron in piers	45,000
Total amount of iron	375,000

Stone-masonry	cubic yards	1,375
Wagon-road bridge, at elevation	feet	34
Total length, about	do	300

These wagon-road bridges may be shortened by grading down the approaches on each side of the canal, a reduction having already been effected of 20 feet in each

case from the present elevation of road in the above estimate of 300 feet in length. However, that is optional with the contractor.

The number of wagon-roads may also be considerably reduced by changing the course of the roads so that one bridge will answer for two or more roads. In fact three wagon-road bridges will be amply sufficient, if the contractor finds it to his interest to act on this suggestion.

The stones used in the building of the piers must be of good quality, clean, and free from all checks and shakes, of good bed and build, the facings to be of such general size as the company's engineer may specify. They will be laid true and by line and templet, each stone on its natural bed, and in full beds of mortar made and composed as follows: One part of fresh-ground hydraulic cement of the best quality, and two parts of clean, sharp sand, entirely free from loam; it is to be carefully and thoroughly mixed dry, and a sufficient quantity of water is to be afterwards added to make it of good consistency. The mortar is to be mixed in no greater quantity than is to be required for the work on hand. Any excess that may be left over night, or that may have been standing longer than two hours, is not to be retempered or used in any way. All mortar must be mixed in a proper box made for the purpose, and in no case upon the ground.

All cement furnished by the contractor shall be subject to inspection and test by the company's engineer, and all cement found to be improper or of inferior quality must be immediately removed from the work.

The contractor will be required to procure by purchase from the present owners the right of way of the canal; that is to say, all the land lying upon the line of the proposed work; also all the land necessary for the deposit of the material taken out of the cuttings and conveyed to a short distance, say, 200 feet either side of the canal, which quantity of land, as estimated by the engineers, amounts to about 1,850 acres.

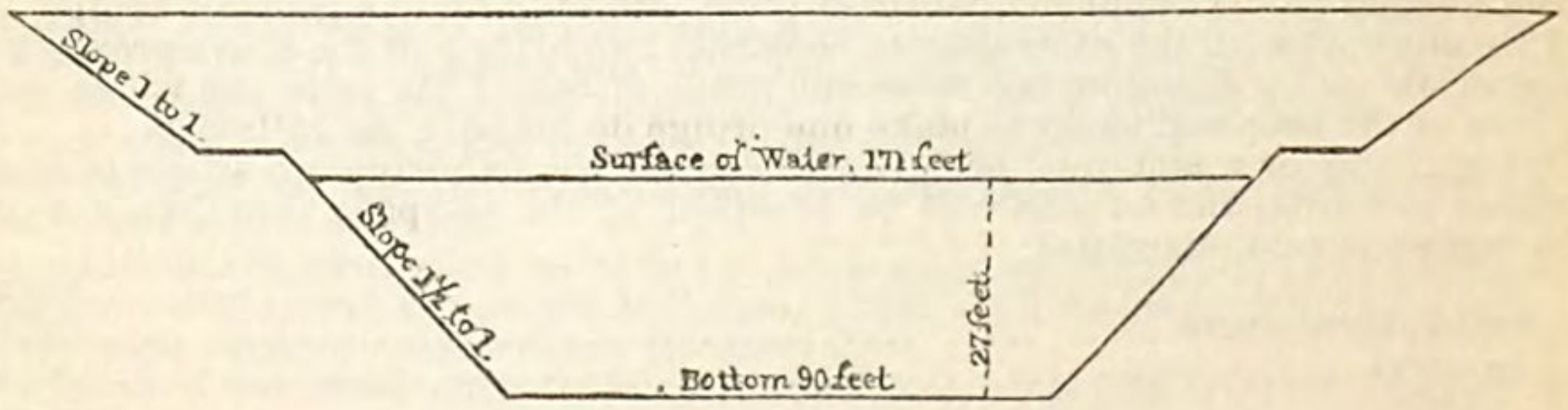
All the dredged material taken from Sassafras River and marsh land will be required to be removed from the vicinity of the work, and deposited in either the Chesapeake or Delaware bays, at such points and places as may be convenient to the contractor, providing that such places as he may choose will not interfere with the existing channels of the said bays, or that any action he may take in procuring a deposit for said dredged material does not involve the company in any trouble or controversy with the general, State, or local authorities, or does not interfere with the rights (chartered or otherwise) of any individuals or corporations.

The time allowed to the contractor to finish the work and hand it over fully completed to the officers of the company will be three years from the date of commencement of such work, such date to be hereafter agreed upon by the contracting parties.

In order to enable the contractor to proceed with the work, and to facilitate its completion within the time specified, an estimate shall be made monthly by the company's engineer, and a certificate delivered by him to the contractor for the full amount of money due him for the work done during the foregoing month, and upon the presentation of such certificate to the proper officer, designated by the company for that purpose, the contractor shall be paid the full amount of such certificate without any reservation whatever.

In case the contractor fails to finish the work within the specified time, he shall be held liable for the interest of the moneys already paid to him by the company from the date of the commencement of the work, such interest to commence at the completion of the specified time, and to continue until the actual completion of the work, such interest to be at the rate of 3 per cent. per annum.

HORACE B. TEBBETTS,
President Maryland and Delaware Ship-Canal.



EXTRACT FROM THE BALTIMORE SUN OF APRIL 7, 1883.

New estimates for the Sassafras Canal—A curious document.—The Count de Lesseps is not more indefatigable in his efforts to "boom" the Panama canal scheme than are

the projectors of the Sassafras Route to the sea to inspire public confidence in that visionary exploit. In a report of Mr. G. M. Totten, under date of March 5, 1883, to Mr. Horace B. Tebbetts, president of the Maryland and Delaware (Sassafras) Ship-Canal Company, a revised estimate of the cost of constructing the canal is presented, based on the requirement that the depth of water in the canal should be 27 feet—equal to that of the channel in the bay—instead of 21 feet, as formerly calculated for. By omitting a walling of the sides of the canal for a distance of 19,700 feet, called for in the estimates made in Mr. Latrobe's report, omitting 13,800 feet of platform, supported on piles, suggested by the same engineer, and making certain other modifications of plan, Mr. Totten succeeds in reducing his estimates for a canal 27 feet deep and 90 feet wide at bottom to $6,575,303, which is $533,348 less than the estimate made by Mr. Latrobe. As this estimate of Mr. Totten differs materially from that of the survey of the United States Engineer Corps, conducted by Capt. Thomas Turtle, under direction of Col. William P. Craighill, which puts the total cost at $11,409,909.81, it will be of interest to examine it somewhat in detail. Mr. Totten fixes the amount of excavation below low water at 10,977,678 cubic yards, costing $1,372,209; the excavation between high and low water at 2,145,584 cubic yards, costing $326,857; excavation above high water, 16,973,775 cubic yards, costing $3,394,755; dredging the channel of Sassafras River, 2,000,000 cubic yards, costing $250,000; concrete covering for certain parts of the canal banks. 13,246 cubic yards, costing $52,984; right of way, $144,000; approaches and bridges, $335,000; engineering, superintendence, and contingencies, $704,496. In contrast with this is the estimate of Captain Turtle that the excavation on the same route below low water will amount to 13,054,619 cubic yards, costing $1,631,827; between high and low water, 2,389,759 cubic yards, costing $358,463; above high water, 20,524,346 cubic yards, costing $4,104,869.

The amount of dredging to be done in the Sassafras River is placed in the Government survey at 18,071,105 cubic yards, against the 2,000,000 estimated for by Mr. Totten, and the two estimates of cost compare as $1,807,110 with $250,000. For the items of dredging in the Chesapeake below Howell's Point, at the outer end of the Brewerton Channel and in Delaware Bay, involving, according to Captain Turtle's report, the removal of 8,927,836 cubic yards of earth at a cost of $892,783, the Totten report makes no allowance, and the same is true of the tide-lock, for which the Government survey allows $229,000. Captain Turtle's estimate allows $337,500 for the single item of bridges, "$946,355 for contingencies," and for a "probable increase" of cost, by reason of finding harder material than has been anticipated, $1,000,000; the last mentioned contingency being one of which the Totten report takes no account. Summing up, the total cost as estimated by Mr. Totten is $6,575,303; as estimated by the Government engineers, $11,409,909. "Specifications" of the work to be done in the canal, put forth by the Ship Canal Company, of which Mr. Tebbetts is president sketch in general terms the route to be pursued, the length (20 miles), the width the depth, and a few other particulars as to the construction, but may be said to be too vague and indefinite for a contractor to base practical estimates upon. The particulars mentioned above are as follows: "The width of the canal shall be 90 feet at the bottom, excepting the 4 miles between Georgetown Bridge and Kennedy's Dam, which shall be dredged to a width of 150 feet, with perpendicular sides or its equivalent. The depth of the canal shall be 27 feet below mean low tide at Georgetown Bridge. There shall be a berme on each side of the canal from 9 to 12 feet in width, according to the depth of the cuttings at a height of 32 feet above the level of the bottom of the canal. The sides of the canal shall have slopes of 1½ to 1 foot below the bermes, and 1 foot to 1 foot above the bermes, so that there will be at the surface of the water in that part of the canal east of Kennedy's Dam a width of 171 feet at mean low tide. The surface of the bermes shall have a covering of concrete half a foot in thickness. The bridging on the canal will consist of two railway and nine highway or wagon-road bridges, and a draw at Georgetown Bridge. All the abutments and piers are to be of stone and iron. The superstructures are to be of iron, and every bridge is to have a draw opening 100 feet. All the material and workmanship must be of the best kind." No contractor, it has been urged, can bid on "specifications" as indefinite as these. No statement is made as to the kind of materials that will be met with in different sections of the work; whether excavations will be paid for with a lump sum or by the cubic yard; where excavated material is to be deposited; how deep foundations of bridges are to be carried; what method of constructing them is to be adopted, or who is to provide approaches to the proposed canal, either in the Chesapeake or Delaware bay. Definite specifications as to the requirements for the construction of railroad or common bridges are also wanting, so that it would seem that the Tebbetts Company have not yet developed their project to the point of presenting it in the shape of proffered contracts based on reliable estimates and leaving an ascertainable margin of profit for those who will take them in hand. In a word, the project has no practical beginning in sight, and until the company can present something more definite the scheme must continue its existence in the misty realm of speculation.

APPENDIX I.

IMPROVEMENT OF THE HARBORS AT WASHINGTON AND GEORGETOWN, DISTRICT OF COLUMBIA—IMPROVEMENT OF THE POTOMAC RIVER IN THE VICINITY OF WASHINGTON, DISTRICT OF COLUMBIA.

REPORT OF MAJOR PETER C. HAINS, CORPS OF ENGINEERS, BVT. LIEUT. COL., U. S. A., OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1883, *WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

1. Harbors at Washington and Georgetown, D. C.
2. Potomac River, in the vicinity of Washington, D. C.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., July 31, 1883.

SIR: I have the honor to transmit herewith the annual reports upon the river and harbor improvements under my charge for the fiscal year ending June 30, 1883.

Very respectfully, your obedient servant,

PETER C. HAINS,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

I 1.

IMPROVEMENT OF THE HARBORS AT WASHINGTON AND GEORGETOWN DISTRICT OF COLUMBIA.

HISTORY.

In 1804 a petition was presented to Congress by citizens of Georgetown, D. C., stating that the channel of Potomac River was obstructed by a mud bank recently formed below Mason's (Analostan) Island, and asking that Congress give permission for the erection of a dam between the island and the Virginia shore, with a hope of improving the navigation.

An act was passed early in 1805 by Congress, authorizing the erection of the dam referred to, and a short time afterwards it was built. The dam did not, however, have the desired effect, as the bar appears to have become shoaler instead of deeper each succeeding year.

It became necessary to adopt other means of deepening the water across this bar; accordingly, "a *mud machine*" was put at work by the

corporation of Georgetown. In 1824 an ordinance was passed authorizing its sale.

In 1825 a resolution was passed authorizing the Mayor "to employ a suitable person to stake out the channel made with the '*mud machine*,' and keep it staked out during the year 1825."

By act approved March 11, 1833, Congress appropriated one hundred and fifty thousand dollars—

to aid the citizens of Georgetown in removing the obstructions to their navigation by causing the cut already made through the bar below the town to be enlarged and deepened, and for the further purpose of enabling them to make a free turnpike road on the Virginia side of the river, and to purchase and make free, forever, the bridge over Little Falls.

Under an ordinance of the corporation of Georgetown, approved March 30, 1833, Walter Smith, John Kurtz, Joel Crittenden, and John Laird were appointed commissioners to superintend the improvement of the navigation of the river. They were authorized to employ a suitable and competent person to examine and survey the condition of the cut, its width and depth, and make estimate for increasing the depth of water to 16 feet, and its width to 200 feet.

By a subsequent ordinance, the above-named commissioners were empowered to contract for the execution of the work. It appears also that a contract was made with C. & P. T. Ellicott, and on March 14, 1835, it was annulled on account of their failure to comply with its stipulations.

The commissioners were then authorized and requested to apply to the Secretary of War for the services of a competent engineer to survey and make a correct plat of the channel, and an estimate of the quantity of excavation necessary to secure a channel 200 feet wide and 15 feet deep at low tide.

November 7, 1835, the commissioners were authorized to contract for the removal of the bar below the Long Bridge, and subsequently $5,000 was applied to this work.

The books of the corporation of Georgetown show that of the amount appropriated by Congress by the act of March 11, 1833, the sum of $48,266.60 was expended for the improvement of the river. Of this amount, $5,000 was expended in deepening the water on the bar below Long Bridge, and the remainder ($43,266.66) in dredging the "cut" above.

In 1867, Maj. Nathaniel P. Michler, Corps of Engineers, United States Army, was assigned to the duty of making a survey and examination of the river in the vicinity of Washington, District of Columbia, with a view to its improvement, and subsequently to the charge of the work, after an appropriation was made.

During the summer of 1869, the corporate authorities of Georgetown, at their own expense, caused the bar in the Georgetown Channel to be dredged out to a depth of 13 feet at low tide, and a width of 80 feet. About 13,000 cubic yards of material was excavated, at a cost to the city authorities of about $10,000.

By act of Congress approved July, 1870, an appropriation of $50,000 was made for the improvement of the river between the Long Bridge and Georgetown. This is regarded as the first appropriation made by the National Government for the improvement of the river in the vicinity of Washington, District of Columbia.

The appropriation made in 1833 was to *enable the citizens of Georgetown* to remove obstructions, and for other purposes.

In October, 1870, there occurred a heavy freshet in the Potomac. The

water rose to a height of 15.9 feet above the zero of the gauge at Morgan's Wharf (foot of G street).

This zero, the plane of mean low tide, is the same that has been taken as the standard in all subsequent surveys. It is fixed by a bench-mark established by Major Craighill, Corps of Engineers, United States Army, on the rock in the river that lies about 200 feet northwest from the Analostan boat-house.

The freshet of 1877 has been regarded as the highest known, and was so regarded by Mr. Abert, who established bench-marks along the river shore.

The freshet line of 1877, according to Abert, is only 13 feet above the plane of reference at G Street Wharf, while Craighill makes that of 1870 15.9 feet above the same level. Even the ice gorge in 1881 only caused a rise at G street of 13.71 feet.

In November, 1870, Major Michler was relieved by Maj. W. P. Craighill, Corps of Engineers, United States Army, under whose direction the appropriation was expended in making a channel 200 feet wide and about 14 feet deep at low tide.

The entire sum was devoted to the improvement of the Georgetown or Virginia Channel, though the question of opening a channel along the Washington shore was not overlooked.

March 3, 1873, an appropriation of $50,000 was made by Congress for improving the harbors of Washington and Georgetown, District of Columbia.

By act approved June 23, 1874, Congress enacted that the appropriation made the previous year should be expended, so far as it were practicable, by depositing the excavated material in conformity with the plan of the Board of Survey constituted by the act of March 5, 1872.

In July, 1874, Mr. S. T. Abert was placed in charge of the improvement of Washington and Georgetown harbors, relieving Colonel Craighill.

A channel 200 feet wide, and from 15 to 16 feet deep at low tide, was dredged through the bar above Long Bridge, and a similar one below. Over 114,000 cubic yards of material, consisting of mud and sand, was taken from the upper cut, and about 32,000 cubic yards from the lower one; the material being all deposited on the adjacent flats. The work was done under a contract with W. H. Beard, of Brooklyn, N. Y., at $16\frac{7}{8}$ cents per cubic yard. It was begun September 15, 1874, and finished June 24, 1876.

The following fiscal year (1876–'77) a portion of the appropriation which had not been expended was applied to the removal of the rocks in Georgetown Harbor. For details respecting this work, see the Annual Report of the Chief of Engineers for the year 1877.

During the latter part of November, 1877, there occurred what is generally supposed to be the heaviest freshet in the Potomac River of which there is any record. The river at the Aqueduct Bridge rose to a height of $13\frac{1}{2}$ feet above ordinary high tide, at the Long Bridge 6 feet, and at the Arsenal $5\frac{2}{3}$ feet. This freshet being the highest known (with the possible exception of that of 1870) has been taken as the standard for estimating the greatest probable rise of the river at any future time.

The effect of this freshet was to cause the deposit of large quantities of sediment in the channel dredged only two years before. This channel filled up to such an extent that the depth was reduced from 15 feet to 9 feet, in consequence of which the merchants of Georgetown raised funds by private subscription, and had the shoalest part of the bar

dredged at their own expense. A small balance of the appropriation of June 23, 1873, was applied to widening the channel thus dredged, 5,500 cubic yards of material being removed.

June 18, 1878, Congress made another appropriation of $50,000 for improving the harbors of Washington and Georgetown, of which sum $20,000 was to be expended in Washington Harbor and $30,000 in Georgetown Harbor and Channel. It was decided with this appropriation to dredge out the Washington Channel 200 feet wide and 12 feet deep, and the Georgetown Channel, above Long Bridge, the same width and 16 feet deep. The contract for the work was let to Messrs. Brainard & Kerr, of Washington, August 9, 1876, but they, after doing a small amount of work, failed, and on November 16, of the same year, the contract was annulled.

In January, 1879, the work was let to Messrs. George C. Fobes & Co,. of Baltimore, Md., by whom it was carried out. The material, 159,979 cubic yards, taken from the Georgetown Channel, chiefly sand, was deposited on the Potomac Flats near by, and within the line of the bulkhead wall, as proposed by the Board of Survey in 1872. The material from the Washington Channel was mud, and was deposited on the flats of the Eastern Branch. The cost of the dredging in each channel was 13$\frac{9}{10}$ cents per cubic yard. March 3, 1879, Congress made another appropriation of $50,000 for this improvement, $20,000 of which was to be expended on the Washington Channel below Long Bridge, and $30,000 on the Georgetown Harbor and Channel. As the Georgetown Channel was being dredged at the date of this appropriation, it was decided to let only that portion of the work covered by the $20,000 available for the Washington Channel, and excavate a channel, 15 feet deep and 75 feet wide, close to and along the front of the wharves from Arsenal Point up to Long Bridge. A contract was made for this with Messrs. George C. Fobes & Co., of Baltimore, Md., and under it 90,744 cubic yards of material were excavated at 15 cents per yard. About $5,000 of the appropriation remained unexpended at the end of the fiscal year.

The $30,000 remaining of the appropriation made by act of March 3, 1879, was not drawn from the Treasury, but was reserved for the time when the Georgetown Channel would fill up again, as it was confidently expected it would do.

The act of June 14, 1880, appropriated $40,000 for continuing the improvement in Washington and Georgetown harbors, including the removal of rocks.

No work was done in the Georgetown Channel during the fiscal year 1880–'81, for the reason that the channel dredged during the previous year fulfilled all the needs of commerce. An examination, however, was made of Georgetown Harbor and estimates made of the rock excavation necessary to render navigation safe.

September 11, 1880, bids were received and opened for additional excavation in the Washington Channel, and the bid of the National Dredging Company of New York, at 14 cents per cubic yard, was the lowest, and was accepted. No place of deposit of the dredged material was provided by the Government, and after fruitless efforts to secure dumping grounds the contract was, on the application of the contractors, annulled by the Secretary of War in June, 1881.

On March 3, 1881, an appropriation of $50,000 was made for improving the harbors of Washington and Georgetown, District of Columbia. This sum, with the balances of former appropriations, made over $120,000 available for work on July 1, 1881. It was proposed now to

apply about $25,000 of this sum to the removal of rocks in Georgetown Harbor, and a portion of the remainder to dredging the Washington Channel, with a view to forming a winter harbor, the material to be dumped on the flats below and close to the causeway of the Long Bridge. Proposals for the work was invited by public advertisement and a contract awarded in July, 1881, to the National Dredging Company. Under this contract the Washington Channel was dredged to a depth of 15 feet and a width of 200 feet. The means of deposit in this case were different from any heretofore applied in this locality. A railway on piles was built from a point near the north end of the causeway from Long Bridge nearly across the flats. It was equipped with two locomotives and twelve cars. The grade of the railway was fixed at 9 feet above low water at the northeast end, with a rising grade of 1 foot to 300. A reservoir or basin was dredged alongside the northeast end of the railway. Dredges worked in the stream, dumping the material into scows; these were towed to the receiving basin and their contents dumped into it. It was here dredged up again and delivered into the cars, which conveyed it to the place of deposit on the flats. The material was mostly soft black mud, and 240,000 cubic yards were taken out and deposited on the flats, at a cost of 24 cents per cubic yard.

The material when dumped from the cars spread out so that the surface of the ground thus made took a slope of about 30 base to 1 vertical. In this way about fifteen acres of marsh were covered.

Twenty-five thousand dollars having been set aside for the removal of rocks in Georgetown Harbor, proposals were invited for this work. The estimated amount of fast rock to be removed was 1,600 cubic yards. The only bid received was that of Thomas P. Morgan, jr., of Cumberland, Md., on July 9, 1881, at $28 per cubic yard. As this bid was considered too high, it was rejected.

In March, 1882, an examination of Georgetown Channel showed that it had shoaled up in places, and that it began to cause some inconvenience. The draught of the vessels visiting the port had considerably increased since the improvements of the channel had been made. It was therefore determined to dredge through the bars above and below Long Bridge, so as to secure 17 feet of water at low tide, and a channel width of 200 feet. The $30,000 of the appropriation of March 3, 1879, and $15,000 of the appropriation of March 3, 1881, was allotted to this work, and proposals were invited accordingly. The estimated amount of material to be removed was 125,000 cubic yards, and it was to be deposited on the Flats near Easby's Point, District of Columbia. The contract was awarded to the Potomac Dredging Company, at 28 cents per cubic yard; the work to be completed by September 1, 1882.

On September 1, 1882, in compliance with Special Orders No. 188, dated Headquarters of the Army, Adjutant-General's Office, Washington, August 14, 1882, I relieved Mr. S. T. Abert of the charge of the improvement of the harbors at Washington and Georgetown, District of Columbia.

The contract with the Potomac Dredging Company was transferred to me, having been extended by my predecessor two months. At the expiration of this time the contract was not one-third completed, and, inasmuch as proposals had been received for precisely similar work at $21\frac{2}{10}$ cents per cubic yard, it was not deemed advantageous to the Government to further extend it; consequently the contract expired by failure of the Potomac Dredging Company to finish their work within the required time.

It was thereupon decided to apply the sum of $43,531, which was

available for the improvement of Georgetown Harbor, to the removal of rocks that obstruct navigation. Accordingly a survey of several groups of rocks in Georgetown Harbor was made with a view to their removal to a depth of 20 feet at mean low tide, this being the proposed depth of the channel below.

Five groups of rocks were surveyed. The soundings were taken at distances of 2½ feet and plotted on maps of a convenient scale. From these maps their contents are easily computed to a plane of any depth of less than 20 feet at mean low tide.

The rocks are designated by groups as follows:

First group.—A_{iii}, about 390 feet below the Aqueduct Bridge.

Second group.—D_i and D_{ii}, off G Street Wharf, distant from the shore about 300 and 150 feet respectively.

Third group.—B and B_i, opposite mill sluice, and distant from Georgetown shore about 350 feet.

Fourth group.—F and F_i, opposite Potomac boat-house, and distant from Georgetown shore about 525 feet.

Fifth group.—C_i, C_{ii}, C_{iii}, C_{iv}, and C_v, near the Knickerbocker Ice Company's Wharf.

The approximate estimate of their contents to a plane 20 feet below low tide is as follows:

	Cubic yards.
A_{iii}, about	132
D_i and D_{ii}, about	268
B and B_i, about	378
F and F_i, about	60
C_i, C_{ii}, C_{iii}, C_{iv}, and C_v, about	6,056
Total, about	6,894

The project, as approved by you, was for the removal of all the rocks to a depth of 20 feet below low tide. The estimated cost of removing the rocks C_i, C_{ii}, C_{iii}, C_{iv}, and C_v, however, being more than the funds available, it was determined to limit the work, for the present, to the removal of the others.

Proposals were invited by public advertisement, and on June 6, 1883, bids were received and opened. The following is an abstract of the same:

Abstract of proposals opened by Maj. Peter C. Hains, Corps of Engineers, at Washington, D. C., on June 6, 1883, for the removal of rocks in Georgetown Harbor, District of Columbia.

No.	Names and addresses of bidders.	Price for removal of group—				Total amount.
		A_{iii}.	B and B_i.	D_i and D_{ii}.	F and F_i.	
1	Edward McDonald, Astoria, Queens County, New York.....per cubic yard..	$27	$25	$26	$32	.....
2	American Dredging Company, Philadelphia, Pa.*	2,300	6,500	4,500	1,100	$14,400
3	Thomas P. Morgan, Washington, D. C.†	4,488	12,852	9,112	2,040	28,492

* Date sf commencement, on or before September 1, 1883; date of completion, on or before December 31, 1883.

† Date of commencement, July 1, 1883; date of completion, July 1, 1884.

The award was made to the American Dredging Company, it being the lowest responsible bidder. The work is to be commenced not later than September 1, proximo, and completed by December 31, 1883.

Other rocks in Georgetown Harbor ought to be removed, but further surveys will be necessary to determine their character and quantity.

CAUSEWAY BETWEEN ANALOSTAN ISLAND AND VIRGINIA SHORE.

There is to be seen, between the Virginia shore and Analostan Island, the remains of a dam or causeway, built about eighty years ago for the purpose of deflecting the water that formerly passed down on the west side of the island into the Georgetown Channel.

It was expected that this dam would deepen the water on the bar below Easby's Point. This expectation was not realized. The dam remained in existence until a few years ago (1877), when it was partially destroyed by a freshet. Since then it has not been rebuilt. This dam, though not a part of the project of improvement, ought to be rebuilt to the height of ordinary high water, or a little above that level. The good effect of this outlet in reducing the height of the flood line in Georgetown was shown at the time the dam was partially destroyed. The water had reached a height along the Georgetown wharves, doing great damage to property, and was still rising when the dam gave way. It was followed at once by a rapid fall of several feet, and further damage averted.

If this dam were rebuilt, in the form of a wier, to the level of ordinary high water, the good effects of throwing all the water into the Georgetown Channel during its low stage would be secured, while at the same time it would serve as an outlet for the surcharged waters of the river during freshets.

Amounts appropriated are as follows:

June 11, 1870	$50,000
March 3, 1873	50,000
June 18, 1878	50,000
March 3, 1879	50,000
June 14, 1880	40,000
March 3, 1881	50,000

The work is in the collection district of Georgetown, D. C., which is the nearest port of entry. Nearest light-house, Jones' Point, Virginia.

Revenue collected for the year ending June 30, 1883, $19,513.92.

Money statement.

July 1, 1882, amount available		$57,621 59
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$11,154 53	
July 1, 1883, outstanding liabilities	773 27	
		11,927 80
July 1, 1883, amount available		45,693 79
Amount (estimated) required for completion of existing project		60,189 91
Amount that can be profitably expended in fiscal year ending June 30, 1885		60,189 91

STATISTICS OF RECEIPTS AND SHIPMENTS AT THE HARBORS OF WASHINGTON AND GEORGETOWN, DISTRICT OF COLUMBIA, DURING THE YEAR 1882.

Asphalt	$71,844 00
Cement (foreign)	74,856 00
Coal (bituminous)	944,961 50
Cattle	64,196 00
Coal (anthracite)	993,600 00
Corn	212,500 00
Fertilizers	453,580 00

Fish, (shad, herring, &c.)	$142,562 00
Oysters	144,320 00
Flour	1,046,700 00
Hay and straw	76,900 00
Ice	567,600 00
Lumber	504,700 00
Laths and pickets	65,537 00
Oak and pine wood	140,800 00
Paving blocks	70,848 00
Potatoes	54,291 75
Shingles	54,250 00
Wheat	1,123,060 00
Sulphur (40 tons).	
Phosphates (60 tons).	
Miscellaneous	271,207 00
Total	7,078,313 25

The shipment of Cumberland coal was small on account of the "strike," which lasted until September 1, 1882.

The following table shows the amount of miscellaneous freight (value not known) brought to these harbors:

	Tons.
By steamer from New York	58,250
By steamer from Philadelphia	25,000
By steamer from Baltimore	5,570
By steamer from Norfolk	54,500
By river steamers	36,000

Ferry and local passenger steamers not included.

ARRIVALS OF STEAMERS AND SAILING VESSELS DURING THE YEAR 1882.

Steamers drawing from 6 feet to 14 feet	708
Vessels drawing from 14 feet to 18 feet	441
Vessels drawing from 9 feet to 12 feet	670
Vessels drawing from 7 feet to 9 feet	685
Vessels drawing from 4 feet to 6 feet	1 030

Also a number of small sailing boats, or pungies, trading in fruits and vegetables.

I 2.

IMPROVEMENT OF POTOMAC RIVER IN THE VICINITY OF WASHINGTON, DISTRICT OF COLUMBIA, HAVING REFERENCE TO THE IMPROVEMENT OF NAVIGATION, THE ESTABLISHMENT OF HARBOR LINES, AND RAISING OF THE FLATS.

HISTORY.

The oldest map of the Potomac River in this vicinity, of which there is any record, was made by M. Ellicott, civil engineer, in 1792. The original is now preserved in the office of the Commissioner of Public Buildings and Grounds, but copies of it have been made at various times. The soundings indicated on it were made by Ignatius Fenwick and Richard Johns, and were referred to the plane of mean tide (a plane midway between high and low tide).

This map gives us the earliest authentic information touching the topography of the bottom of the river in the vicinity of Washington. There are traditions relative to the depth of water in old channels, and documents in existence that purport to give information of an earlier date, but implicit faith cannot be placed in such traditions, and the reliability of statements in documents cannot now be verified.

There is a tradition that the main channel of the Potomac was formerly on the Maryland, or Washington side of the river, and some topographical features of the banks favor this, but there seems to be no information of an authentic character to prove it. In support of this tradition, it is said that vessels engaged in foreign trade received their cargoes at a point not far above the mouth of Tiber Creek, the present southern terminus of Seventeenth street; also that General Braddock, when he started on his memorable expedition against the Indians in 1755, landed his forces at a rock in front of the site of the present Naval Observatory. This rock has been known since as "Braddock Rock." It does not necessarily follow, however, that there was deep water up to the rock, for the landing may have been in small boats, the larger vessels lying out in the stream.

The winter of 1779–'80 is said to have been one of exceptional severity and of long duration, and that in the spring, when the ice broke up and melted under heavy rains, the "waters came down in a great torrent, carrying with it a whole forest of trees which had been uprooted from the low grounds near Little Falls." This immense mass of ice and wood gorged in front of Georgetown, and the pent-up waters, unable to find their way down-stream by the usual route along the front of Georgetown, burst through the low grounds connecting what is now Analostan or Mason's Island with the mainland on the Virginia side, and plowed a new channel through it, forming an island that did not before exist.

Some doubt is thrown on this tradition from the fact that the map of Jefferson and Fry, published in 1775, and purporting to be "a map of the most inhabited parts of Virginia and Maryland," shows Mason's Island was in existence at that time and was known by that name.

From debates which took place in Congress on the question of authorizing the construction of the dam from Mason's Island to the Virginia shore in 1804, we find it stated by Mr. Lewis, of Virginia:

> That before the year 1784, the channel on the western side was so shallow that vessels only of very ordinary draught could pass, while on the Maryland side vessels of great draught of water could easily pass up to Georgetown.
>
> The uncommon hard winter of 1783–'84 was followed in the spring by the greatest torrents ever known in the Potomac. The bodies of ice were of immense magnitude, and many of them lodged upon the island and under the rocks of its bed. Pressing with a force beyond all credulity it tore the rocks asunder and pressed them over into the river channel, occasioning a rise of 30 or 40 feet on the Georgetown shore. On the Virginia side the torrent also forced itself and deepened that channel, while it left a vast quantity of mud, rocks, and sand in the eastern channel, which has been constantly accumulating since that period.
>
> The situation of the present bar is at the union of the two arms of the river below the island, and does not permit the passage over it of vessels, drawing more than 12 feet water.

The condition of affairs previous to 1784, described by Mr. Lewis, is perhaps correct. The depth of water on the bar, as he states in 1804, is not greatly different from what it was in 1792, as shown by Ellicott's map. At the time this map was made there were three channels in front of the city.

The *first*, commenced at the head of Analostan Island, near the site of the Virginia abutments of the Aqueduct Bridge, passed between Analostan Island and the Virginia shore, followed along the latter as far as the present site of Long Bridge, thence, by a gentle curve, convex towards the Washington side, it pursued its course until it met the waters of the Eastern Branch near Giesborough Point.

The *second*, or middle channel, called the "Swash," was a continuation of the Georgetown channel which swept along the front of the Georgetown wharves, and after passing Easby's Point, curved gently

towards the Washington shore and passed through the site of Long Bridge at a place nearly in the middle of the present causeway, uniting with the Washington Channel a short distance below.

The *third* channel, called the Washington or City Channel, was a branch from the Georgetown Channel, which, after reaching Easby's Point, separated into two parts—one the Swash, just described; the other, following close along the Washington shore, united with the Swash a short distance below the site of Long Bridge.

If the soundings on this map be correct, they show that at the date referred to the deepest water was in the Virginia Channel, which passed around the south side of Analostan Island; that 10 feet at mean low tide was the depth on the bar below the island; that 15 feet was the depth on the bar below the site of Long Bridge at mean low tide. It also shows that by following the present Virginia or Georgetown Channel, 8 feet was all that could be carried over the bar below Easby's Point.

The Swash Channel was deep for some distance below Easby's Point, but shoaled up to 6 feet at low tide, near the place of junction with the Washington Channel.

The depth of the Washington Channel above Sixth street was less than 12 feet at low tide, was only 3 feet off the mouth of the Tiber, and less than that above it.

Evidently if vessels of great draught had formerly passed up to Georgetown by way of Washington Channel, the shoaling process must have been very rapid.

From the map of the harbor of Washington and Georgetown, and a comparison with later surveys, one may form an idea of the changes that have taken place in the river during a period of less than a century.

No survey of the river seems to have been made between the date of Ellicott's survey, in 1792, and that of Lieut. Col. James Kearney, of the Corps of Topographical Engineers, in 1834. The chart of the river made by this officer is a valuable one, and shows some interesting features in the topography of the bottom of the river. The soundings on this map are referred to extreme low water, which may be taken at about 2 feet below mean low water, the usual plane of reference.

An examination of this map shows that the old channel, which came down between Analostan Island and the Virginia shore, had ceased to exist. A dam or causeway, built across this channel in 1806 to throw the water all into the Georgetown Channel, had of course rendered it useless.

A shoal not shown on the Ellicott map will be found reaching from the southeasterly end of Analostan Island nearly half-way to Long Bridge. This shoal was dry at extreme low tide. Another shoal dry at low water extended from Long Bridge in a westerly direction more than half-way to Analostan Island, and in an easterly direction about a quarter of a mile below the bridge. This shoal, as a dry one at extreme low water, has since disappeared.

Another feature disclosed by this map is the closing up of the city or Washington Channel. According to the Ellicott map this channel passed close along the Washington shore until it joined the Georgetown Channel above Easby's Point. The Kearney map shows this channel entirely cut off from the Georgetown Channel. It was no longer, properly speaking, a channel. The remains of it only existed in the shape of a long and narrow strip of water between the Washington shore and the dry shoal which reached from the main land just below Easby's

Point, in an easterly direction, to a point some distance below the mouth of Tiber Creek.

The *Swash* or Middle Channel, which, according to the Ellicott map of 1792, had about 6 feet on the bar at its junction with the city channel below Long Bridge, had, according to the Kearney map, become almost dry at extreme low tide. Other surveys subsequent to the Kearney survey have been made at short intervals as follows:

In 1837 a survey of the Potomac River, from Long Bridge to the mouth of the Anacostia, and up that river as far as the Navy Yard Bridge, was made by Lieutenant Ewing, and is on file in the office of the Coast and Geodetic Survey.

In 1842 a survey of the same rivers was made by Lieutenants Young and Whiting, of the United States Navy. The survey was made by order of the Secretary of the Navy, Hon. A. P. Upshur, and reached as far as Alexandria.

On the 3d of March, 1849, an appropriation of $1,500 was made by Congress to enable the Secretary of War to execute a survey and examination of the river that had been ordered by a resolution of the House of Representatives on August 8, 1848, but for which no funds were provided. This survey was made by Capt. Campbell Graham, Corps of Topographical Engineers, in 1849, and reaches from the Aqueduct to Long Bridge. This map is on the files of the Department.

In 1857 a survey of the river from the Aqueduct to Long Bridge was made by R. W. Burgess, civil engineer, under the directions of Capt. I. C. Woodruff, of the Corps of Topographical Engineers. This map is on file in the Department.

In 1862 Carlile P. Patterson, of the Coast Survey, made a survey of the river from the Aqueduct Bridge to Giesborough Point, and of the Eastern Branch as far up as the Anacostia Bridge. A large number of soundings were taken, giving a good representation of the topography of the bottom of the river. A few years later the survey was extended to Little Falls.

In 1867 a survey of the topography of the banks of the Potomac, from Analostan Island to Long Bridge, was made by Charles Fendall, Assistant on the Coast Survey.

In 1871 a hydrographic map was made of the Potomac River, from Aqueduct Bridge to Giesborough Point, under the direction of Maj. W. P. Craighill, Corps of Engineers, by J. E. Weyss and G. Thompson, assistant engineers. This map is on file in the Engineer Department.

Since 1871 the river has been several times examined and the channels surveyed where dredging was done.

In 1881 a survey of the river was made by S. T. Abert, civil engineer, in accordance with the provisions of the river and harbor act of March 3, 1881. This was for the purpose of devising plans for the improvement of navigation, the establishment of harbor lines, and the raising of the flats.

The surveys enumerated are of themselves a history of the river. On the Ellicott map we trace the Washington or City Channel, not deep, it is true, though even above Seventeenth street a stream of water large enough to be dignified by the name of a channel.

Kearney's map shows this channel closed below Easby's Point at extreme low tide, and it is probable that at ordinary low tide a canoe could not have gone through it.

Abert's map shows the channel no longer in existence above Sixteenth street, and scarcely more than a rudiment of it above Long Bridge.

The Swash Channel, which Ellicott's map shows had a navigable

depth of 6 feet at low tide in its shoalest parts, had by 1834 only a depth of 2 feet where formerly there had been from 6 to 8 feet.

Abert's map of 1881 shows no vestige of the Swash Channel. Its disappearance is so complete that one would not suppose from any signs on the map that it had ever had an existence. Years before the causeway of Long Bridge was built this channel had well-nigh filled up. After the causeway was built the filling-up process was accelerated, so that in 1881 we find ground dry at low tide where in 1792 there had been from 8 to 10 feet of water. On the other hand, the Georgetown Channel, which in 1792 gave only a navigable depth of 8 feet at low tide, had in 1881 a navigable depth of 15 feet. It is to be observed, however, that this increased depth was not due to natural causes, but was the result of excavations made under the auspices of the Government.

In a similar manner the growth of the flats on either side of the river may be traced. Ellicott's map does not show what the depth of water was on the shoals. It gives soundings only along the line of each channel, but between the channels shoals must have existed. The Kearney map shows that at extreme low water a portion of the flats below Easby's Point was exposed; that near the Long Bridge there were two shoals dry at extreme low tide, the smaller one a short distance below it and about 1,000 feet from the Washington shore; the larger one close to the Virginia Channel and crossed by the Long Bridge. The latter exposed a dry area of about one hundred acres at extreme low tide in 1834. Since then most of that portion of it above Long Bridge has disappeared, the water being now from 3 to 5 feet deep where formerly it was dry.

These maps show the growth of another shoal close to the Virginia shore, and immediately below Analostan Island. The filling up of this space as far down as Alexander's Island has been almost as rapid as the filling of the flats on the Washington side.

The Ellicott map shows deep water close up to the Virginia shore, while Abert's map shows a large area of dry ground at low tide.

The act of Congress making appropriations for certain civil expenses of the Government for the year ending June 30, 1857, approved August 18, 1856, authorized the Secretary of the Interior to cause drawings and estimates to be made for the construction of an iron suspension and a stone arch bridge, at or near the site of the present Long Bridge, and for a bridge at or near the place known as the "Three Sisters," and at some eligible intermediate point, with a view to enabling Congress to select a site for a bridge across the Potomac River. The report was made by Alfred Landon Rives, civil engineer, February 5, 1857, to the Secretary of the Interior, and by him transmitted to Congress. It was published in House Ex. Doc. No. 68, Thirty-fourth Congress, third session. In his report he calls attention to the fact that the consideration of plans for a permanent bridge at Washington is so intimately connected with a project for the improvement of the navigation of the river that one cannot properly be matured without a due consideration of the other. He then presents a plan for the improvement of the navigation of the river, as well as plans for a bridge.

The plan of the improvement proposed by him seems to have been the first official presentation, in behalf of the Government of the United States, of a definite plan for the improvement of the river in this vicinity.

The object of the work done by private enterprise previous to that time was to secure, at the least cost and in the shortest time, a narrow channel through the bars to the entrance to Georgetown Harbor.

The plan proposed by Mr. Rives had for its object the permanent im-

provement of navigation, and consisted in opening a clear water-way 1,770 feet wide along the Washington shore, by removing the existing causeway and replacing it temporarily by a wooden structure on piles, lowering the dam connecting Mason's Island with the Virginia shore, so as to bring it to the level with ordinary high tides, and terminating its upper surface by an inclined plane of masonry, dredging a short, new channel across the flats; building a breakwater from the southern part of Mason's Island to deflect the current of the river into the new channel; and, finally, reclaiming one hundred and sixty-six acres of the flats at the mouth of the Tiber, thus giving a continuous deep channel along the Washington shore. The Tiber, or, more properly, the city canal, to be continued to the new shore line, and guard-locks to be placed at its entrance into the river. In short, his plan was to close the deepest and open the shoalest, and what was for a part of the way no channel at all.

The plan proposed would reclaim somewhat more than one hundred and sixty acres of marsh land lying between Easby's Point and Long Bridge, by advancing the city front, but it left a large area of marsh land on the opposite side of the channel, and the proposed dam across the Virginia Channel would largely add to it in a few years.

Nothing appears to have been done by the Government subsequent to the publication of Rives' report, until March 2, 1867, when Congress, in making appropriations for the repair, preservation, and completion of certain public works, &c., directed the Secretary of War to cause examinations or surveys, or both, to be made of the Potomac River in the vicinity of Washington, D. C.

On the 27th of July, 1867, Maj. Nathaniel Michler, Corps of Engineers, was assigned to the duty of making a survey. A report was made by him April 30, 1868. He advised that in order to give immediate relief to the pressing needs of commerce that the Virginia Channel (which at this time had on the bar below Analostan Island only about 8 feet water at low tide) be dredged out to a suitable depth; that the Washington Channel below Long Bridge be deepened in the same manner; that the causeway of Long Bridge be removed to be replaced by an arched bridge, or one on piles of wood or iron; that the Washington Channel be then extended to the Georgetown Channel, near Easby's, by cutting through the flats between Easby's Point and Long Bridge; that a dam or breakwater be built from the *south* end of Analostan Island to deflect the water to the Washington side of the river.

The plan is essentially the same as that submitted to the Hon. R. McClelland, Secretary of the Interior, on the 7th of February, 1857, by Alfred C. Rives, civil engineer, and already described.

Under the provisions of act of Congress approved March 5, 1872, a Board of Survey was created for the purpose of devising and submitting to Congress a comprehensive plan of improvement, not only in respect to navigation, but also with reference to its sanitary effect on the city of Washington, and the possibility of reclaiming in any plan of improvement the swamp and marsh lands along the water front. The Board consisted of the Chief of Engineers, United States Army, the Superintendent of the Coast Survey, the Engineer in charge of Public Grounds and Buildings, the Governor of the District, Alexander Shepherd, and Carlile Patterson. This Board made a report which was printed in Senate Mis. Doc. No. 15, Forty-second Congress, third session.

The Board submitted three plans for consideration, as follows:

A. To carry the main channel from the lower end of Analostan Island, across the flats above Long Bridge and below Easby's Point, into the small channel running

along the Washington front, at or near the intersection of Seventeenth and C and D streets southwest, and thence continue along the present front of the city until it joins the deep channel of the river just below the Arsenal.

B. To have two channels forming the flats above and below the Long Bridge into an island. The main deep channel to remain along the right bank of the river down to Gravelly Point, just below Long Bridge, and thence to the deep water off Giesborough Point. The second and smaller channel to run from a point just below Easby's Point, across the flats, with its upper edge touching the end of the wharf at Seventeenth street west, and thence along the present Washington front until all the channels join the deep channel of the river off Giesborough Point.

C. To have but one channel of sufficient width and depth for all purposes; a direct continuation of the river to Georgetown, to run along the right bank of the river as far down as Gravelly Point, and thence directly towards Giesborough Point on the left bank, joining the deep channel of the river at that point, following nearly the present main channel of the river.

The last plan was the one recommended for adoption by the Board.

The channel of the harbor up to the Aqueduct Bridge was to have a depth of 23 feet at mean low tide, and sufficient width to allow of the easy handling of vessels and the discharge of the heaviest freshets.

A bulkhead, built of wood artificially preserved, was to extend from Easby's Point along the Washington side of the proposed channel, and the area between it and the present shore line was to be filled in to a height of 6 feet above high water. The city front was to be moved out to this line, and the reclaimed area laid out in streets and lots. Wharfage facilities were to be had by the piers that were to be built along the front of the bulkhead wall. A basin 3,300 feet long and 500 feet wide was to be kept open along the Washington Channel near the Arsenal, and the navy-yard was to exchange places with the Arsenal. It was proposed to rebuild the Long Bridge with greater spans and a larger draw, to be located at right angles with the channel.

The width of the river at Long Bridge was to be increased by cutting off about 1,350 feet of Alexander's Island, at the south end of the bridge. The material obtained from the excavations was to be used in filling the flats, the "B street" sewer was to be extended to the new front of the city; the dam at the mouth of Rock Creek to be removed; the projecting point of Analostan Island was to be cut off, so as to widen the river in front of Georgetown and give it a more gentle curve.

The plan advanced the entire city front to the edge of the Virginia Channel, and reclaimed all the flats from overflow. The plan contemplated the improvement of the Anacostia, or Eastern Branch of the Potomac, as far as the crossing of the bridge above the navy-yard.

April 16, 1878, a resolution was passed in the House of Representatives of the United States, directing—

> That the Secretary of War be directed to cause to be made an examination of the flats in the Potomac River from the Observatory Grounds to Monument Lot, for the purpose of ascertaining the practicability of the erection of a dike along the western edge of the said flats, and report to the House the feasibility and cost thereof, and what effect such dike would have on the sanitary condition of the city of Washington.

This work was assigned to Lieut. Col. Thos. Lincoln Casey, Corps of Engineers, by whom a report was made June 12, 1878, which is published in House Ex. Doc. No. 70, Forty-fifth Congress, third session.

Colonel Casey, without committing himself in favor of the project, submitted a plan for diking the portion of the flats referred to. The dike to begin at Easby's Wharf and follow southerly along the western edge of the flats about 2,500 feet, and thence eastward to the shore near the Monument, and having a total length of 7,072 feet. The dike to be built of earth, to be 30 feet wide on top arranged for a carriage way, to have slopes of 1 base to 2 vertical, and to be riprapped on both sides to

prevent washing by the waves and currents. The level of the top of this dike to be such that a flood, like that of 1877, would not pass over it. The space within the dike was to be formed into an artificial lake, which was to be deepened by dredging to prevent the growth of aquatic plants. Water was to be admitted into the lake at high tide, through sluiceways to be provided for the purpose and emptied in the same way as often as circumstances required. "B street" sewer was to empty into the lake, the deposits from it to be removed by dredging and the water of the lake to be kept clean by frequent changing. About one hundred and seventy-three acres of the flats would be inclosed by this means, and he estimated the cost at $275,267.

Colonel Casey states "that it is entirely practicable to build this dike, but it is difficult to predict the effect this improvement will have on the sanitary condition of the city." He suggests as a cure for the evils referred to, the project of the Board of Survey of 1872.

In February, 1881, there occurred the most disastrous flood of late years, as measured by the damage to property. It was caused by an ice gorge forming at or near Long Bridge, which dammed up the regular channel of the river and caused the water to pass off to either side.

The preceding winter had been a severe one, and ice of unusual thickness had formed. The gorge was preceded by heavy rains, but they produced no great rise in the river. At the Aqueduct Bridge the rise was about 2 feet less than the freshet of 1877, and at Giesborough Point nearly 3 feet less, while just above Long Bridge it was more than 3 feet higher. Great damage was done to property lying along B street and the low portions of Pennsylvania avenue, as well as to wharf property along the river front.

Differences of opinion seem to exist as to the place where the gorge first formed, but there seems to be no reasonable doubt that it was caused chiefly by the obstruction to the flow of water through Long Bridge. The spans of the present bridge being only 140 feet, obstruct the flow to an injurious extent in times of freshets, and below it there were at the time the remains of the old Washington and Alexandria Railroad Bridge, built in 1863. These remains are now being removed, so that the waterway between the piers will not be obstructed to the same extent as formerly.

Major Twining, Corps of Engineers, and Engineer Commissioner, District of Columbia, proposed a plan of improvement to the Commissioners of the District of Columbia, and in their annual report to Congress for the year ending June 30, 1879, they called attention to the condition of the river front, and asked the immediate attention of Congress, not only as a measure of health, but also with reference to the commercial interests of the city.

The Commissioners state that the accretions to the flats have reached that point when it is necessary that some decisive action be taken to abate what is rapidly becoming a gigantic and intolerable nuisance.

Twining's plan is a modification of the plan adopted by the Board of Survey in 1872. The plan recommended by that Board, as already stated, was to move the entire city front out to the Virginia Channel by filling in all the intervening space. Twining proposed as modifications to that plan—

First. To leave the present Washington Channel open as far up as Long Bridge, and to make use of sluicing basins for the purpose of purifying the water in that channel, which would otherwise become stagnant and offensive.

To accomplish this flushing, basins were to be provided on that sec-

tion of the flats between Long Bridge and the sewer canal which were to automatically discharge about 14,000,000 cubic feet of water on the last third of each ebb-tide.

Second. To reduce the width of the Virginia Channel to 2,000 feet and give it a mean depth of 12.27 feet and extreme depth of 25 feet, and, as a measure of safety, to carry Long Bridge on trestles, on the Virginia side, for a sufficient distance to give a total extreme high-water section of the river at the bridge of 45,000 square feet.

The wharfage line was to be carried down from Georgetown as far as the Seventeenth street sewer canal, with a uniform depth along its whole front. Easby's Point was to be cut off so as to give a channel area of about 24,000 square feet.

In order to give the river in front of Georgetown a more easy curve, a portion of Analostan Island was to be cut off to a depth of 6 feet, this depth being sufficient to prevent the growth of aquatic plants. In order to lower the flood line to some extent along the Georgetown front, the old channel-way back of Analostan Island was to be opened to such width as to give about 5,000 square feet additional area.

Third. To change somewhat the distribution of the reclaimed land. That portion above the sewer canal he proposed to raise at once to the height of 4 feet above the flood line of 1877, and divide it into lots, extending the streets to the bulkhead line. The portion between the sewer canal and the Long Bridge was to be laid out as a park, with ornamental lakes or ponds, covering about one hundred acres. These lakes were to furnish the water for purifying the Washington Channel or basin. Below the bridge, the work for the present to be regulated by the future demands of the city. He proposed, therefore, at present to fill in not more than one-half the area to be reclaimed.

His plan also contemplated the building of a catch-sewer, along the city front, from the Long Bridge down, which should convey the sewerage to James' Creek, on the opposite side of the Arsenal, and prevent contamination of the water in the Washington harbor.

The act of March 3, 1881, directed that a survey of the Potomac and Anacostia rivers be made, in the vicinity of Washington, District of Columbia, with reference to the improvement of navigation, the establishment of harbor lines, and the raising of the flats, so far as their improvement may be necessary to the improvement of navigation and the establishment of the harbor line. The survey was made by Mr. S. T. Abert, civil engineer, and plans and estimates were submitted by him for the improvement.

His plans differ from that of Twining, chiefly in respect to details. He recommends the retention of the Washington or City Channel as far as Long Bridge widened to 800 feet and deepened to 20 feet; a basin of about thirty-three acres to be kept open above Long Bridge, with a depth of 10 feet at low tide for a wood-harbor, &c., for small vessels.

The line bounding the filled area differs slightly from that of Twining. Near Easby's Point it reaches out nearly to deep water, avoiding considerable rock excavation; Analostan Island is not to be touched, but about 400 feet is proposed to be taken off Gravelly Point, so as to widen the river at the site of the bridge. No change in the location of the Long Bridge is suggested. The reclaimed area to be inclosed by a dry masonry wall resting on piles, and to be filled to a height of 6 feet above low water (3 feet above high water), to be inclosed by an embankment along its edge, sufficiently high to exclude freshets. This area to be drained by pipes through the embankment, furnished with valves to prevent the inflow of the tide.

With a view to reduce the cost and at the same time reclaim the flats from overflow, he suggested another plan, namely, to fill the area to 6 feet above low tide, protect it by a slope of riprap resting on a footing of stone, and omit the embankment. This would allow the submergence of the area every time the river rose more than 6 feet above ordinary low tide.

To protect the city from floods, an embankment was proposed from Eigtheenth street to Monument Lot. This embankment could only keep out surface water, however, and would not prevent the water from coming into the city through the sewers.

Mr. Abert refers to a canal, 200 feet wide and 20 feet deep, from the city channel across the flats above Long Bridge, that could be built and save about 3 miles for boats passing from the wharves of Washington City to those of Georgetown, but makes no suggestion as to the expediency of opening it.

On January 26, 1882, by Special Order No. 11, from Headquarters Corps Engineers, a Board of Engineers, consisting of Col. Q. A. Gillmore, Corps of Engineers, and brevet major-general United States Army, Lieut. Col. C. B. Comstock, Corps of Engineers, brevet brigadier-general United States Army, and Lieut. Col. W. P. Craighill, Corps of Engineers, was convened for the purpose of considering and reporting on plans and estimates for the improvement of navigation of the Potomac River in the vicinity of Washington, District of Columbia, the raising of the flats in front of the city, and the establishment of the harbor lines.

About all the plans that had ever been thought of were laid before this Board for its consideration. Besides those already described, another plan for reclamation and improvement was considered by the Board. It was to reclaim the areas proposed in the plans of Abert and Twining, but instead of doing it by filling, adopt the method practiced in Holland; that is, build a dike around the area to be reclaimed, inclosing it so that water could not enter from the river and but little from surface drainage on the land side. The top of the dike to be 3 feet above the freshet line of 1877, and 20 feet wide on the top, with slopes of 4 base to 1 vertical. The interior to be drained by small canals to a basin, in which the water should be kept 3 feet below the surface of the ground by means of steam pumps. The banks of the sewer canal to be diked to a height of 3 feet above the freshet line of 1877, and the drainage of that portion of the flats above the canal to cross it in a siphon.

In connection with this plan no means were proposed to purify the water of the Washington Channel below Long Bridge.

Material for the dikes would be furnished by dredgings from the channel which it was supposed, after having been deepened, would remain so. What would be the probable effect of a freshet with the Washington Channel closed, and all the water usually discharged through it thrown into the Virginia Channel, is not stated.

No provision seems to have been made for taking care of this large increase of flood water, but unless the current itself deepened the channel considerably, dredging would have to be resorted to in order to increase the discharge capacity of the remaining channel.

It is not intended to discuss the merits of the several plans that have been proposed from time to time, but it will readily be understood that any plan that contemplates closing of the Washington Channel at Long Bridge ought to provide for an increased discharge capacity of the Virginia Channel in time of freshets.

The Board of Engineers, after a careful consideration of all the plans

brought to its attention, made a preliminary report, dated February 18, 1882, recommending a plan described by the Board as follows:

> This Board is of the opinion that an improvement which shall combine substantially and in its essential features the harbor and shore lines of Mr. Abert's plan from Easby's Point to the Arsenal, and the low-grade filling and surrounding embankment of that plan below the Long Bridge, with a cheaper revetment than he proposes, with Major Twining's high-grade filling and sluicing-ponds between the Long Bridge and Easby's Point, offers a better solution of the various questions connected with the improvement of navigation, the establishment of the harbor lines, and the reclamation of the flats than any of the other projects or combination of projects that have been considered. It is regarded as necessary to the proper execution of this plan as thus defined that the channel depths in both Washington and Georgetown harbors should be sufficient to accommodate the largest draught that can be brought up to Arsenal Point, with such additional depth at the wharves that vessels can receive their full cargoes without grounding at low water; that the filling over the flats above the Long Bridge, as well as the crest of the surrounding embankment below, should be carried up to a height of 3 feet above the flood slope of 1877; that the flushing ponds should not be less than 8 feet deep, and be provided with inlet and outlet gates of ample dimensions, automatically arranged, for filling the ponds from the Georgetown Channel to the level of high water and emptying them into the Washington Channel to the level of low water during each oscillation of the tide; that an ample system of drainage for the reclaimed areas be provided; that all sewage now discharging into the Washington Channel should be intercepted and conveyed away to the James Creek sewer canal east of the Arsenal; and that the Long Bridge shall be rebuilt, at an early period during the progress of the improvements, with wide spans upon piers offering the least possible obstruction to the flow of water.
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> The Board recommends the adoption of this plan of improvement, with such modifications of details, to be submitted in a future report, as a further study of the subject may suggest as advantageous or expedient.
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> It is estimated that the cost of the improvement as recommended will be about $2,500,000.
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> It is desirable that an appropriation of not less than $1,000,000 should be made in one sum.
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> The Board recognizes the principle that the area of the tidal compartment of a stream should be diminished as little as possible in any project designed solely or mainly for the improvement of the channel. In the case under consideration other interests than those connected with navigation are to be subserved, the reclamation of the flats, with the consequent reduction of the capacity of the tidal basin, being one of the leading objects to be attained. The mischief, if any shall ensue, from nonconformity to a well established law, will not, it is thought, be serious, and it will be felt, if at all, below the Arsenal, and not at the site of the works.
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This report was submitted to Congress, and a select committee of the Senate was appointed to investigate and report as to the condition of the Potomac River in front of Washington. The testimony taken before this committee was published in Senate Mis. Doc. No. 133, Forty-seventh Congress, first session.

By act of Congress, passed August 2, 1882, an appropriation of $400,000 was made as follows:

> Improving the Potomac River in the vicinity of Washington with reference to the improvement of navigation, the establishment of harbor lines, and the raising of the flats, under the direction of the Secretary of War, and in accordance with the plan and report made in compliance with the river and harbor act approved March third eighteen hundred and eighty-one, and the reports of the Board of Engineers made in compliance with the resolution of the Senate of December thirteenth, eighteen hundred and eighty-one, four hundred thousand dollars.
>
> And it is hereby made the duty of the Attorney-General to examine all claims of the title to the premises to be improved under this appropriation, and see that the rights of the Government in all respects are secured and protected; and if he deems it necessary he is authorized to cause a suit or suits in law or in equity to be instituted, in the name of the United States, in the supreme court of the District of Columbia, against any and all claimants of title under any patent which in his opinion was by mistake or was improperly or illegally issued for any part of the marshes or flats within the limits of the proposed improvement.

DESCRIPTION OF THE RIVER.

In its ordinary stages the Potomac River above Little Falls is scarcely more than a good-sized mountain stream, though it, in connection with its branches, drains an area of about 20,000 square miles of territory.

In times of freshets, which always follow a long spell of rainy weather, in the region drained by the upper river, the volume of water is increased, and comes down with power and velocity proportional to the extent and duration of the rainfall, carrying with it, sometimes, trunks of trees, leaves, and a large amount of sediment washed from the cultivated slopes of its banks.

The average rise and fall of the tides is about 3 feet, and except in times of freshet the tidal wave is felt all the way to Little Falls, though the current is generally down stream.

The tides and currents are both greatly influenced by the wind. A strong northwester will make a very low tide and a strong southeaster a high one. On one occasion, a few years ago, the tide was observed to fall as low as 3 feet below ordinary low-water mark.

The river above the Aqueduct and as far down as Easby's Point is narrow and deep. There are places above the Aqueduct Bridge where the water is 85 feet deep. The bottom is hard, generally rock or gravel. At Easby's the river changes in its character. From a width of about 900 feet it suddenly widens out to over 5,000 feet, and the bottom becomes soft mud, with frequent layers of sand, some vegetable matter, small pebbles, and shells. The river continues wide all the way to its mouth, a narrow deep channel being bordered on each side by large areas of shoals. The latter are made by the deposit of material from the river, washed into it by heavy rains. The lighter portions being held in suspension, do not settle until they reach a place where the water is comparatively quiet. The coarser material is rolled along the bottom, and comes to rest as soon as the velocity of the current is sufficiently retarded to lose the power of imparting motion to it. Thus we find the coarser material generally in the channel, and the finer in the bays and indentations along the shore where the current is less swift.

Above Easby's Point but little deposit of sediment takes place. The current, in times of freshets, is strong, and no deposit of light material can take place except when obstructions, either artificial or natural, produce eddies, and in times of dry weather the river is comparatively clear. But when Easby's Point is passed, the river widens out to more than five times its width above, and a rapid retardation of the currents takes place; the material swept along the bottom soon comes to rest; that held in suspension is carried farther on and deposited in the quiet places behind projecting points. Thus we find in the Georgetown Channel coarser and heavier material than is found on the flats. The former is brought down the river by freshets; the latter comes not only during freshets, but whenever local rains wash out the light material turned up by the plow on the hillsides, while the sewage poured into the river is a continuous source of supply.

The rapid growth of the shoals in the vicinity of Washington, of late years, may be explained by the large area of land brought under cultivation in the region drained by the Potomac and its branches; by the building of wharves; by the discharge of sewage into the river, and by the Long Bridge. The soil of a region covered with forests is washed out but little by heavy rains; but when cleared and the land plowed up the wash is considerable.

The building of wharves produces eddies and deflects the current from its natural course.

The discharge of sewage furnishes a continuous supply of shoal building material.

The causeway of the Long Bridge has done a good deal in promoting the rapid growth of the Potomac Flats, but it was not the original cause of their formation, as is popularly supposed. The causeway was built because the flats were there, and it was supposed it would tend to deepen the water in the Virginia Channel. The flats were the cause, not the result of the causeway.

After the flats had reached a sufficient height to support a growth of aquatic plants, the deposit of sediment was more rapid, and in the immediate vicinity of the sewer canal the thick growth of weeds furnished a first-class settling basin for the worst products of the sewers. This material, after spreading out over the flats, is for several hours during the day exposed to the direct rays of the sun. In fact, a portion of the flats above the sewer canal has grown to such a height that it is exposed at least two-thirds of the day.

The opinion that disease-producing germs are thus generated is a prevalent one, and seems to be warranted by high medical authorities.

It is certain that the effluvium from these flats is at times so nauseous as to make it impossible for persons to go near them without being sickened. Practically, they have made a section of the city, otherwise highly favored, almost uninhabitable. Not the least objectionable feature is their proximity to the official residence of the Chief Magistrate of the nation, adding another to the reasons for their reclamation.

For testimony of medical and other authorities as to the effects of the flats on the sanitary condition of the city I need only call attention to Senate Mis. Doc. No. 133, Forty-seventh Congress, first session, being the testimony taken before the Senate select committee appointed to report as to the condition of the Potomac River in front of Washington.

Apprehensions have been felt and expressed by some, and this improvement has been opposed on the ground that the contraction of the width of the river will increase the destruction of private property by freshets; that the channel being narrowed, the water will "pile up," so to speak, and cause a rise higher than ever before. A little thought ought to dispel all such apprehensions of danger. If the width of the river was reduced, the depth remaining the same, there would be ground for such apprehensions. Herein lies a strong objection to any plan of improvement that would close the Washington Channel without increasing the capacity of discharge of the Virginia Channel.

The work proposed is not intended to, nor can it, prevent freshets, but it is confidently expected that they will do less damage when the improvement is completed than heretofore.

It is a well known principle in hydraulics, that water flows faster in deep channels than in shallow ones. If the area of the cross-section remain the same, the discharge will be greater as the water is deeper.

If instead of discharging through the two channels at Long Bridge the water was all concentrated into one of them, and the area of the cross-section of that one made equal to or greater than that of the two combined, the discharge would be greater; in other words, the river above would not rise so high.

The velocity of flow would be increased on account of the greater depth, and the surface of the water above will be lowered.

This improvement contemplates bringing about just that condition of the river.

The area of discharge at and near Long Bridge will be increased rather than diminished, though the Washington Channel be closed.

This will be done by deepening the river and at the same time cutting off a portion of Alexander's Island at the south end of the Long Bridge; consequently there will be less damage done by floods than heretofore.

These principles are so well known that a reference to them may seem out of place in a report of this kind, but as the objections referred to have been repeatedly urged by intelligent persons in the District, I thought it not out of place to refer to the subject.

LONG BRIDGE.

The Board of Engineers which recommended the plan of improving the Potomac River in the vicinity of Washington, called attention to the necessity of rebuilding the Long Bridge with wide spans, upon piers that will offer the least possible obstruction to the flow of water. Nearly every engineer who has proposed a plan for improving the river has called attention to the necessity of rebuilding this bridge.

It is an obstruction to navigation that ought to be removed altogether or rebuilt on a less objectionable plan. Only a few days ago a schooner, in passing through, damaged the draw to such an extent that for several days it was kept closed and no vessels were able to go through.

The bridge was built in the year 1808 by the Washington Bridge Company, under an act of incorporation provided by an act of Congress, approved February 5, 1808, entitled "An act authorizing the erection of a bridge on the Potomac River, within the District of Columbia."

This act fixed the site of the bridge, provided for a company to build it, and authorized the collection of tolls at certain rates.

The bridge, as at first built, was finished and opened to travel on the 1st of May, 1809. It cost, in round numbers, $100,000.

Its length from shore to shore at that time was 4,984 feet, of which 2,659 feet was built on shoals now called the flats.

The portion over the flats was built on thirty-nine stone and earth piers, 25 feet square each.

In 1830, Congress appropriated $6,000 to enlarge the Virginia Channel draw to 66 feet, and reduce the width of the bridge, which had been 36 feet, to 24, and $2,000 to enlarge the Maryland draw to a width of 35 feet.

In February, 1831, a part of the bridge was carried away by a freshet, and it became necessary to rebuild it.

By act approved July 14, 1832, Congress appropriated $60,000 towards the construction of a new bridge, $20,000 of which was to be paid to the stockholders of the Washington Bridge Company, if upon valuation it was found that the remains of the former bridge were worth that sum. The plans of the bridge were to be such as the President of the United States should approve.

By an act approved March 2, 1833, Congress made another appropriation of $200,000.

It was decided to build a stone arched bridge. A contract was made for the work and preparatory steps taken to construct it.

Before any actual work had been accomplished, Congress, by act approved June 30, 1834, repealed the two previous acts, and appropriated $130,000 for rebuilding the bridge on the same site and on a plan similar

to the old one, but authorizing the construction of a causeway of earth or other solid material over the shoals that then existed, and which are now known as the flats.

In the winter of 1840 a portion of the bridge was again carried away by the sudden breaking up of the ice. The damage was repaired and the bridge opened for travel in October, 1843, at a cost of about $48,000.

By act, approved March 3, 1863, Congress authorized the Washington and Alexandria Railroad to extend their road from the south side of the Potomac across said river to and along Maryland avenue.

The railroad company was also empowered to build an additional structure alongside of Long Bridge for the passage of their trains. A railroad bridge, on piles, was accordingly built close to and alongside the present bridge.

The remains of this bridge, which formed a serious obstruction to the flow of ice in the river, have recently been removed.

By act of Congress approved June 21, 1870, the Baltimore and Potomac Railroad was authorized to cross the Potomac River by way of Long Bridge, extending its tracks over said bridge so as to connect with any railroads constructed or to be constructed in the State of Virginia. The railroad company was authorized to take possession of the bridge, provided it was kept in good condition for railroad and ordinary travel, and so far as its use for the latter purpose was concerned to be free.

The company is required to keep proper draws for the passage of vessels through it; to repair damages without cost to the United States; to allow other railroads the privilege of passing upon reasonable terms, and in case of neglect to comply with the above requirements the United States is authorized to take possession. The right to alter or amend this law was at the same time reserved to Congress.

Since that time the bridge has been a free bridge for ordinary travel, and has come to be used by all railroads centering at Washington from the South.

The old railroad bridge alongside the Long Bridge thus became useless and was dismantled, the piles on which it was built being alone allowed to remain in the ground.

The spans of the present bridge are too short, being only 140 feet in the clear; the piers obstruct the flow of water to a much greater extent than is necessary. This is a matter of comparatively little importance when the river is in its ordinary condition.

The Virginia abutment extends too far out into the river. This abutment should be removed and the bridge carried on piers for a distance of about 400 feet on the Virginia side; at the same time a portion of Alexander's Island, on which this abutment stands, should be removed.

When the river is in its ordinary condition the upward current of the flood tide is only slightly felt at the Long Bridge.

The ebb current is stronger, and its direction follows closely that of the Virginia Channel; but when the river is swollen by a freshet, the ebb current no longer follows the channel, but takes a shorter cut to reach its level.

The piers of the bridge are located to best suit the low stage of the river, but in the freshet stage they stand obliquely to the current, thus making obstruction greatest when it should be the least.

Another great objection to the present bridge is the large amount of rip-rap stone that is piled around the piers. This is all under water

and not visible, but it presents a formidable obstacle to the flow of water.

If the land to be reclaimed above and below the site of the causeway be converted into a park, it is essential that the railroad should cross it on an elevated track, sufficiently high to allow vehicles to pass under.

If the bridge is to be maintained on its present site, it should be rebuilt. The estimated cost of a suitable structure, including approaches, elevated track over the flats, &c., will not be much less than $1,500,000.

OPERATIONS OF THE PAST FISCAL YEAR.

The plan for the improvement of the Potomac River having been definitely fixed by law, it only remained to carry it out in such a manner as to insure the greatest immediate benefit to commerce, to the sanitary condition of the city, and to the best interests of the Government.

By Special Orders No. 188, dated Headquarters of the Army, Adjutant-General's Office, Washington, August 14, 1882, I was assigned to the charge of the work.

September 12, 1882, I submitted a project for the expenditure of the appropriation. This project was approved by you in a letter dated September 26, 1882.

The appropriation had in view three objects: The improvement of navigation, the establishment of the harbor lines, and the raising of the flats.

To accomplish the greatest useful effect with the money appropriated, it was determined to apply $300,000 to the dredging of a channel, about 400 feet wide and 20 feet deep at low tide, from the deep water near Easby's Point to the deep water off Giesborough Point. This would give a navigable channel of ample dimensions for the accommodation of the largest class of vessels likely to visit this harbor.

The total area of flats to be reclaimed is about 750 acres, of which about 127 will be occupied by lakes.

The work may be divided into three sections:

Section I. That portion between the Sewer Canal and Easby's Point.

Section II. That portion between the Sewer Canal and Long Bridge.

Section III. All that portion below Long Bridge.

The estimated amount of material required to fill each section is as follows:

	Cubic yards.
Section I	3,596,740
Section II	4,068,463
Section III	4,664,455
Total	12,329,658

In order to secure a channel about 400 feet wide and 20 feet deep, it was found that 1,100,000 cubic yards would have to be excavated from the channel on the upper side and 600,000 cubic yards from the channel on the lower side of the bridge.

As it was desirable to have Section I filled first, it was determined to deposit all the material taken from the channel above Long Bridge on that section. Moreover, the condition of the flats made it desirable that as much space be covered as was possible with the material available; instead, therefore, of raising a small area to the full height of 3 feet above the freshet line of 1877, it was decided to fill only to a height of 3 feet above high tide. The material when spread out to that level would suffice to cover more than two-thirds of this section, reclaiming about one hundred acres of the worst part of the flats.

The material to be dredged below Long Bridge could not be brought up to Section I without greatly increasing the cost, the distance from the place of dredging to the place of deposit being more than 3 miles, with the Long Bridge intervening.

The nearest place of deposit for this material, and the most natural one, was in Section III.

Specifications were accordingly drawn with that view, and advertisements published in a number of the principal papers inviting proposals for the work.

The method of doing the work was left to the contractor, who was required to state in his proposal the plan to be adopted, and, while it was not intended to restrict him in the means employed, they were required to be such as would satisfy the engineer that they were adapted to the work.

The proposals were opened on Monday, October 30, 1882. The following is an abstract of the bids received:

Abstract of proposals opened by Maj. P. C. Hains, Corps of Engineers, at Washington, D. C., on October 30, 1882, for dredging in the Potomac River near Washington, D. C.

[Estimated as follows: Between Easby's Point and Long Bridge, 1,100,000 cubic yards; below Long Bridge, 600,000 cubic yards; amount allotted to the work, $300,000.]

No.	Names and addresses of bidders.	Date of commencement.	Date of completion.	Above Long Bridge.	Below Long Bridge.
				Pr. cu. yd.	*Pr. cu. yd.*
1	W. H. Adams, Washington, D. C	Nov. 15, 1882	Aug. 31, 1883	$0 19½	$0 19½
2	Rittenhouse Moore, Mobile, Ala	Feb. 1, 1883	Aug. 31, 1883	27	21. 9
3	Geo. C. Fobes & Co., Baltimore, Md	Jan. 1, 1883	Aug. 31, 1883	.....	29
4	National Dredging Company, Washington, D.C.	Dec 1, 1882	Aug. 31, 1883	34	24
5	American Contracting and Dredging Company, New York.	Feb. 1, 1883	Aug. 30, 1883	24¾	24¾
6	W. H. Beard, Brooklyn, N. Y	.....	.....	36	36
7	Moore & Wright, Portland, Me	Dec. 1, 1882	Aug. 31, 1883	40	36
8	P. Sanford Ross, Jersey City, N. J	Nov. 20, 1882	Aug. 31, 1883	21. 2	21. 2
9	Morris & Cummings Dredging Company, New York City.	10 days after award of contract.	July 31, 1883	36	36

NOTE.—If moved in scows, to be measured by cubic contents. If not in scows or boxes, on the dump after the water has run off.

With the approval of yourself and the honorable the Secretary of War, the contract was awarded to P. Sanford Ross, of Jersey City, N. J., who was the lowest responsible bidder. Mr. Ross entered immediately on the execution of the work.

The material is dredged from the channel and deposited in bottom dumping scows. These, when loaded, are towed to a receiving basin alongside of a railroad and then discharged. The scow is then towed back to the dredge and filled again, to be again unloaded alongside the railroad. At the receiving basin another dredge picks up the material and loads it into cars. The latter are then drawn by locomotives to the place where the material is to be deposited on the flats and there discharged. This plan involves handling the material twice, but that is not an objection, as by a second handling the material is so liquefied that it spreads out well when deposited on the flats.

The contract was approved in November, 1882. The winter months were spent in building dredges, cars, locomotives, railroads, and preparing other plant for the work.

In order to deposit the material on Section I, a railroad was started

from a point about 600 feet beyond the line of the slope protection and 400 feet west of the Sewer Canal. This road has a double track for a distance of about 400 feet, and then by a single track runs parallel to the canal and 400 feet from it.

The specifications require that the foot of the slope which the material takes when deposited on the flats shall not be less than 100 feet from the Sewer Canal. This was a necessary precaution, in order to prevent the filling up of the canal and the consequent stoppage of the flow of the sewage from the great sewer that pours its contents into the river at the foot of Seventeenth street. Two other lines of road branch from near the outer end of the one referred to and run to the main shore. Each track is 400 feet distant from the one adjoining it. The last one has not yet been finished, but the piles on which it is to be built are nearly all driven. It is expected that the railroads already built, or in process of construction, will provide for the distribution of about 1,000,000 cubic yards of material, which will cover about one hundred acres of marsh to the depth of 6 feet. Other railroads will be constructed as the spaces between the lines now built become filled up.

The railroads of Section I are stocked with twenty cars, of 10 yards' capacity each, and one 18-ton locomotive. A train is made up of ten cars. At the outer end of the road, one on each side of it, is a receiving basin into which the material dredged from the river is deposited. With the material dumped in these basins the cars are loaded by means of a clam-shell dredge, they are then run up to the desired point on the road and discharged.

In order to facilitate the flow of material and cause it to spread out, a force pump was put on the work. A 5-inch pipe extends along the side of the track, and is provided with plugs at convenient distances for attaching a hose. By means of this pump, and by dumping the contents of a train continuously in one place, the material is kept in a soft condition, and spreads well out before it hardens.

Two dredges were put to work in April on that part of the channel above Long Bridge; one, an Osgood's improved dipper dredge; the other, a clam-shell. The capacity of the dipper is 2 cubic yards, that of the clam-shell about 4½ cubic yards. The dipper dredge lost considerable time from breakages of machinery, and has thus far accomplished but little work. The other has done fair work; nevertheless, much time has been lost by the breaking of spuds, poles, chains, &c.

The total amount of material deposited on the flats in Section I, up to and including June 30, 1883, was about 125,000 cubic yards, inclusive of that deposited near Easby's Point by the Potomac Dredging Company.

The work below Long Bridge is carried on in a similar manner to that above the bridge, and with a duplication of the same plant. In this case, however, the fill will take place along the center line of the flats, commencing at the fill close to Long Bridge.

The dredges working on this part of the line have about the same capacity as those on the upper.

There has been deposited on the flats in Section III about 74,000 cubic yards; of this amount about 53,000 cubic yards came from the channel, and the remainder from the basin and the approaches thereto.

Total amount deposited on the flats up to June 30, 1883, about 200,000 cubic yards.

There has been built, equipped, and put in operation not less than about 13,000 linear feet of railroad. The road is substantially built on piles, well driven to a firm bearing, many of them being from 60 to 70

feet in length, few less than 50 feet. The rolling stock is first class of its kind. Five dredges have been put on the work, four of which are new.

The four new ones are first-class machines, of large capacity. The dumping scows, five in number, have proved to be too large for handy work; they are from 500 to 600 cubic yards' capacity, but the depth of water at the approaches to the receiving basins is too shallow to allow of their being loaded to their full capacity; consequently no advantage is gained from their large size, while the difficulty of prompt handling is proportionately increased.

Better progress could be made with a greater number of smaller scows. It is hoped that the contractor will soon see the necessity of increasing his plant at work in the channel. By putting on more dredges and the necssary scows, reasonable progress can be made.

The average daily amount of work done ought then to be not less than 6,000 cubic yards.

Simultaneously with the work of dredging the channel and filling the flats, the foundation for the slope revetment, or walk, has been carried on. This was necessary for several reasons; it was needed in order to be able to form an embankment along the edge of the fill for the protection of the latter; the subsoil on which it rests having been found to be very soft, it was necessary that time be given to allow it to settle to a firm bearing. On account of the uncertainties in the character of the bottom, and the possible necessity of modifying the plans as the work progressed, you authorized this work to be done by day's labor, the material to be purchased as far as practicable by contract.

With your approval, it was decided to put in a foundation of riprap, laid on a continuous mattress of brush, the mattress to be laid at a depth of 6 feet below the surface of mean low tide, to be about 1 foot thick and 18 feet wide, made of brush not over 2 inches in diameter at the butt, woven together somewhat on the plan used on the Mississippi River for the revetment of banks, &c. The rip-rap thrown in on top of this mattress will form a solid footing for the slope of the fill, the face of which may be revetted with a paving of stone, or should it be desirable to do so at some future time, a nearly vertical wall of concrete or stone may be laid on it. It is believed it will give a perfectly secure foundation for a solid wall not exceeding 6 feet in height. The rip-rap of loose stone covers the entire surface of the mattress, the middle of the pile being over the center line of the mattress, with slopes of about 2 base to 1 vertical.

In order to lay the mattress it was necessary to dredge a trench 6 feet deep at low tide and not less than 20 feet wide on the bottom.

This involved cutting in some places as deep as 7 or 8 feet. Specifications were drawn up for excavating this trench and the ridge between the trench and the 5-foot curve on that portion of the work near Easby's Point.

Bids were invited by public advertisements, and were opened on the 26th of March, 1883.

The bid of Thomas P. Morgan, for dredging the trench at 7 cents per cubic yard, and the ridge between the trench and 5-foot curve at 14 cents, was the lowest, and was accepted.

The following is an abstract of bids received:

Abstract of proposals opened by Maj. P. C. Hains, Corps of Engineers, at Washington, D. C., on March 26, 1883, for dredging (approximately) 30,000 cubic yards for foundation of slope wall, and (approximately) 35,000 cubic yards on the ridge between the wall and 5-foot curve near Easby's Point, District of Columbia.

No.	Names and addresses of bidders.	Price per cubic yard for foundation.	Price per cubic yard for ridge.	Date of commencement.	Date of completion.
1	J. H. Dewees, Washington, D. C	$0 09	$0 15	10 days*	60 days.
2	Delaware and Chesapeake Improvement Company, Philadelphia, Pa.	9⅜		do	Do.
3	Thomas P. Morgan, Washington, D. C	7	14	do	July 1, 1883.

*After notification of acceptance of proposal.

At the present time about 5,000 linear feet of trench has been finished, and about one-third of the ridge between the trench and 5-foot curve.

The mattress was built in the manner as follows:

A scow 60 feet long and 20 feet wide was fitted up, with an inclined platform about 40 feet long and 20 feet wide reaching over the stern of the scow. The mattress was woven on this inclined platform. A selvedge of about 2 feet in width was first started from the lower end and carried up on each side. This gives a starting place for the brush, which is interlaced diagonally from the selvedge on both sides. As soon as about 35 feet of mattress is finished the boat is pulled ahead and the mattress slides off until only about 2 feet remains on the platform; 35 feet more is then woven, and the boat pulled ahead again. The mattress when in the water floats on the surface; it is then moored over the position it is to occupy in the trench, and sunk by stone thrown on it from the stone scows.

As soon as the mattress is sunk in place the stone scows are moored alongside, and the stone piled on it till the crest of the stone pile reaches about half-way between high and low water.

Stone is delivered in place on the mattress for 74½ cents per cubic yard, by H. P. Gilbert, of Georgetown, D. C., with whom a contract was made after advertising for proposals in the usual way. Bids for the stone were opened on the 26th of March, 1883.

The following is an abstract of the bids received:

Abstract of proposals opened by Maj. P. C. Hains, Corps of Engineers, at Washington, D. C., on the 26th March, 1883, for 15,000 cubic yards rip-rap stone for the slope wall on the river front of the Potomac Flats, Washington, D. C.

No.	Names and addresses of bidders.	Price.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	J. H. Dewees, Washington, D. C	$0 87	20 days from award of contract.	4 months.
2	G. Vanderwerken, Alexandria, Va	93	When required	As required.
3	Jos. T. H. Hall, Washington, D. C	85	April 25, 1883	August 1, 1883.
4	Geo. B. Chittenden, Washington, D. C	97	April 15, 1883	September 1, 1883.
5	David M. Stewart, Washington, D. C	1 49	April 20, 1883	October 20, 1883.
6	David B. Howell, New York	1 67½	May 15, 1883	October 1, 1883.
7	J. A. Blundon, Washington, D. C	86	April 15, 1883	August 15, 1883.
8	Henry P. Gilbert, Georgetown, D. C	74½	May 1, 1883	September 1, 1883.
9	James Reynolds, Washington, D. C	1 75	April 9, 1883	
10	Henry J. McLaughlin, Washington, D. C	94½	April 14, 1883	August 14, 1883.

The brush is furnished by Mr. J. A. Blundon and Mr. George B. Chittenden, both of Washington, D. C., at $2.50 per cord.

Advertisements were issued inviting proposals for brush, the following being an abstract of the bids received:

Abstract of proposals opened by Maj. Peter C. Hains, Corps of Engineers, Washington, D. C., on March 26, 1883, for 600 cords brush for the slope wall on the river front of the Potomac Flats, Washington, D. C.

No.	Names and addresses of bidders.	Price.	Date of commencement.	Date of completion.
		Per cord		
1	*J. H. Dewees, Washington, D. C	$1 75	20 days from award	4 months.
2	Sylvester T. Thomas, Washington, D. C	8 20	April 10, 1883	June 30, 1883.
3	George B. Chittenden, Washington, D. C	2 50	April 15, 1883	September 1, 1883.
4	David B. Howell, New York	5 81	May 15, 1883	October 1, 1883.
5	Henry W. Smith, Washington, D. C	6 50	April 16, 1883	August 1, 1883.
6	J. A. Blundon, Washington, D. C	2 50	April 15, 1883	August 15, 1883.
7	Thomas P. Morgan, Washington, D. C	8 40	April 15, 1883	August 1, 1883.
8	Arthur Quinn and Joseph Crabtree, Washington, D. C.	5 25	April 10, 1883	June 25, 1883.
9	James Reynolds, Washington, D. C	8 00	April 9, 1883	

*Informal and withdrawn.

The award was made to the two lowest bidders, each taking one-half the amount to be furnished.

Four scows were built for handling stone and brush in the construction of the wall; the general dimensions of each are as follows:

	Feet.
Length on deck	60
Length on keel	48
Width	20
Depth	5

The gunwales are built solid, of timber 6 inches in width. There are two fore and aft bulk-heads, built solid like the gunwales.

The timbers of both gunwales and bulk-heads are bolted together by iron bolts at distances of 5 feet, one-half of them being drift-bolts, the other half screw-bolts. The ends of the gunwales and bulk-heads are cut to a level so as to form the rake. The bottom and deck of the scow is planked with 3-inch yellow pine. All the joints and seams of the bottom and sides are carefully calked. These scows were purchased by contract, after inviting proposals in the usual way.

The lowest bidder was James T. Summers, of Washington, D. C., to whom the contract was awarded.

The following is the abstract of bids received:

Abstract of proposals opened by Maj. P. C. Hains, Corps of Engineers, at Washington, D. C., on March 28, 1883, for building four flat-boats.

No.	Names and addresses of bidders.	Number of boats.	Price per boat.	Total price.
1	James T. Summers, Washington, D. C	4		$3,497 44
2	Wm. McDermott and Silas E. Parsons, Washington, D. C	4	$1,129 81	4,519 24
3	William C. Hunter, Washington, D. C	4	1,217 47	4,869 88
4	John B. Ely, Baltimore, Md	4	1,045 00	4,180 00
5	George Cumberland and Conrad F. Bennett, Washington, D. C	4		5,329 00

As the work of filling the flats progressed it became necessary to secure some land, at a convenient point, on which material could be collected for the construction of sluice-gates, slope wall, sewer walls, &c.

Proposals were accordingly invited by public advertisements for filling in about six acres of the flats near the foot of Observatory Hill, the material to be paid for by the cubic yard in place. The contractor to procure it at such place or places as he might find most convenient.

The lowest bid received was that of Mr. Andrew Gleason, at 29 cents per cubic yard. This was regarded as unreasonably high, and they were all rejected.

The following is an abstract of the bids received:

Abstract of proposals opened by Maj. Peter C. Hains, Corps of Engineers, at Washington, D. C., on May 16, 1883, *for filling about six acres of the Potomac Flats, near Easby's Point, Washington, D. C.*

No.	Names and addresses of bidders.	Price.	Date of commencement.	Date of completion.
		Per. cu. yd.		
1	Michael McGowan, Washington, D. C	$0 29½		
2	William Buckly, Washington, D. C	34	Within 5 days	90 days.
3	Andrew Gleason, Washington. D. C	29		
4	Albert Gleason, Washington, D. C	34½	Within 10 days	January 1, 1884.
5	William H. Mohler, Washington, D. C	45	Within 10 days	60 to 70 days.
6	John Cudmore, Washington, D. C	33 40/100	When ordered	40 weeks.
7	J. A. Blundon, Washington, D. C	29¾	10 days	4 months.

Proposals were again invited by public advertisement, to be opened July 12 proximo.

SEWER CANAL.

The attention of Congress should be called to the necessity of taking prompt measures to construct retaining walls to the Sewer Canal.

This canal crosses the flats from the foot of Seventeenth street, but it is merely a shallow ditch, about 60 feet wide, with no retaining walls of any kind. The mud bank on each side has a flat slope, supporting a growth of vegetation that impedes the flow of the sewage through it.

The canal is now about 3,000 feet long, but when the flats are filled in it will be about 3,400 feet.

In filling the flats above the canal it has been necessary to keep the fill well back from it, in order to prevent the canal being filled up by the material washed into it. This made it necessary, in the contract for filling the flats, to provide that the foot of the slope which the material takes when deposited shall not come within 100 feet of the bank of the canal.

When work is started on the opposite side of the canal—that is, between it and the Long Bridge—the same difficulty will be experienced. The most offensive part of the flats is that portion in the immediate neighborhood of the canal; here the contents of the great sewer are diffused at high tide among the reeds that grow along its banks.

The worst part of the flats must be left uncovered unless the material used in filling them be prevented from spreading out and choking the canal.

On December 2, 1882, I addressed you a communication in reference to this matter, calling attention to the necessity of building retaining walls at the earliest practicable day; that there was a question in my mind as to who should build them; should it be done by the Government as a part of the work of filling the flats, or should it be done by the authorities of the District of Columbia as a part of the sewage system of the District? The question was one of law that I was not called upon to decide. It may be stated, however, that the work of filling the flats cannot be properly done without the construction of retaining walls of some kind to keep the deposited material in place.

The land on each side of the canal will be the property of the Government; it may be sold, or it may be used for parks or such other public purposes as Congress may determine.

Retaining walls will enable a large amount of land to be reclaimed.

The canal, in its present condition, is a nuisance, and will injuriously affect the value of the land in its immediate vicinity.

For these reasons it seemed to me that the work is one pertaining to the Government. I therefore submit an estimate for their construction.

The canal should have a width of about 75 feet; thus it will allow the sewer to discharge its contents in the heaviest rains without producing a rise at the shore end of the canal of more than 6 inches above the level of the river outside.

It has, in this respect, an advantage over an extension of the sewer itself.

The walls should be vertical or nearly so. The bottom of the canal should be about 8 feet below the level of low tide; the bottom of the sewer at its point of discharge is now 5 feet below the same level.

The walls should therefore be not less than 14 feet high.

The ground along the line of the canal is very soft, and to secure a safe foundation it would be necessary to drive piles throughout its entire length.

A pair of walls of solid concrete, built on a pile and grillage foundation, it is estimated would cost about $208,144, as follows:

Excavation, 37,800 cubic yards, at 30 cents	$11,340
5,100 piles, 40 to 50 feet long (driven), at $7	35,700
306,000 feet B. M. grillage timber, at $18	5,508
Labor on same $20 per M	6,120
40,800 pounds bolts, at 8 cents	3,264
20,500 cubic yards concrete, at $5	102,500
Lumber for concrete molds and bracing	3,312
6,800 linear feet coping, at $1.50	10,200
Coffer-dam, pumping, &c	10,200
Contingencies	20,000
Total	208,144

Cost per linear foot of canal $61.22.

The sewer extended according to the present design is estimated to cost about $78.53 per foot. Besides the advantage in respect to cost there are other obvious advantages.

It is feared that the odors from the sewage water in the canal may become offensive, but this is not likely to be the case with the system of sluicing that it is proposed to put in operation. The ponds or lakes in Section II will discharge into the canal during the last third of each ebb tide about 10,000,000 gallons of fresh water, or 20,000,000 gallons per day, a quantity sufficient to change all the water in the canal daily. It is not possible that any offensive odors can arise from the canal under such circumstances.

Another advantage of an open canal over a covered sewer as low and as nearly level as this one would have to be is that it can be dredged out at anytime should it become necessary, and instead of a nuisance it would be made an ornamented feature in the reclamation of the flats.

LAKES.

As already stated, there are to be about one hundred and twenty acres of lakes in Section II, between the sewer canal and the Long Bridge.

These lakes have been laid out on the accompanying map chiefly with a view to utility, and can be modified if need be. This arrangement gives a cheap mode of construction.

An endless chain dredge, with a discharge tube 200 or 250 feet in length, ought to excavate the material for a price not exceeding 12 cents per cubic yard; two large dredges of this kind ought to handle 6,000 cubic yards of such material a day.

The lakes should be at least 8 feet deep. A greater depth, however, can be given them, should it be advisable, in order to secure cheap filling.

About 1,800,000 cubic yards of material can be had in the construction of the lakes, enough almost to raise the fill in this section to the height of 6 feet above low tide.

SLUICE-GATES.

Simultaneously with the excavation of the lakes the construction of the sluice gates should be started, for it must be remembered that with the filling of Section II the Washington Channel will be closed above Long Bridge, and in order to prevent the water in it from becoming offensive, arrangements must be made to supply fresh water to it from the lakes.

During the construction of the latter and the filling of this section, a temporary canal may connect the Washington and Georgetown channels. This canal should be utilized afterwards as a part of the lakes, and it should be located with this end in view.

At the same time this work is being done in Section II, the deepening and widening of the channel above Long Bridge should go on. The low-water cross-section of the Washington Channel at the Long Bridge is now about 4,200 square feet.

That of the Georgetown Channel is about 21,000 square feet. The two combined give a total area of about 25,000 square feet. This is to be regarded as the standard low-water cross sectional area of the river.

The freshet cross-section of the two channels combined, taking that of 1877 as a standard, was 48,000 square feet. This must be taken as the least freshet sectional area of the new channel when the Washington Channel is closed.

A single channel with a freshet sectional area of 48,000 square feet will discharge the flood water with a less rise than can the two present channels combined.

In order to secure this increased sectional area, it will be necessary either to deepen the river between the two ends of the bridge spanning the Georgetown Channel, or widen it, or both.

It is probable that the increased scour of the ebb tide, when the river is confined within narrower limits, will do some useful work in this direction, but this cannot be depended on, and it is uncertain in amount.

The distance between the south abutment of the causeway and the Virginia abutment of the bridge is only about 2,000 feet, and as the depth of water cannot be sufficiently increased between the piers of the bridge, it will be necessary to cut off about 400 feet of Alexander's Island and have the bridge carried on trestles or piers for this distance.

The Government doubtless has the power to order this to be done by the railroad company now in possession of the bridge.

Washington City is in the collection district of Georgetown, D C. The amount of revenue collected, and the commercial statistics, are given in the report of the improvement of Washington and Georgetown Harbors.

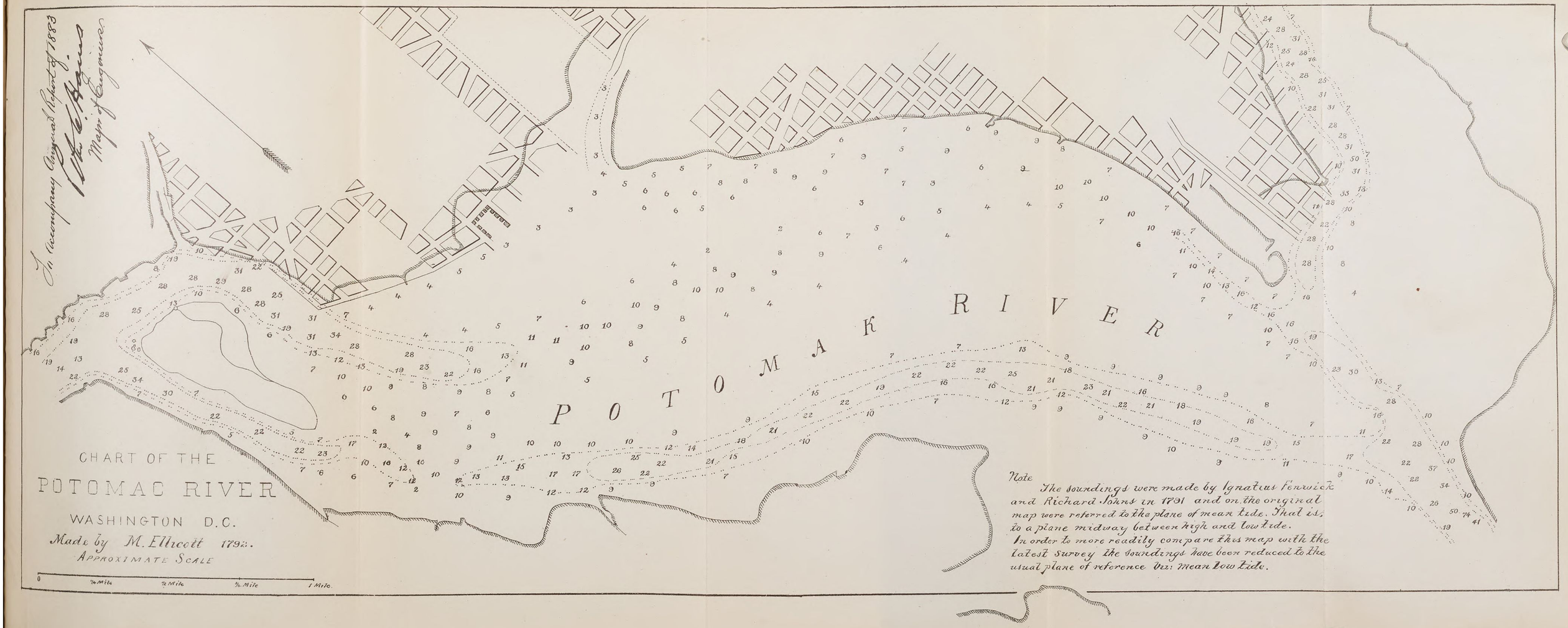
Nearest light-house, Jones' Point, Virginia.

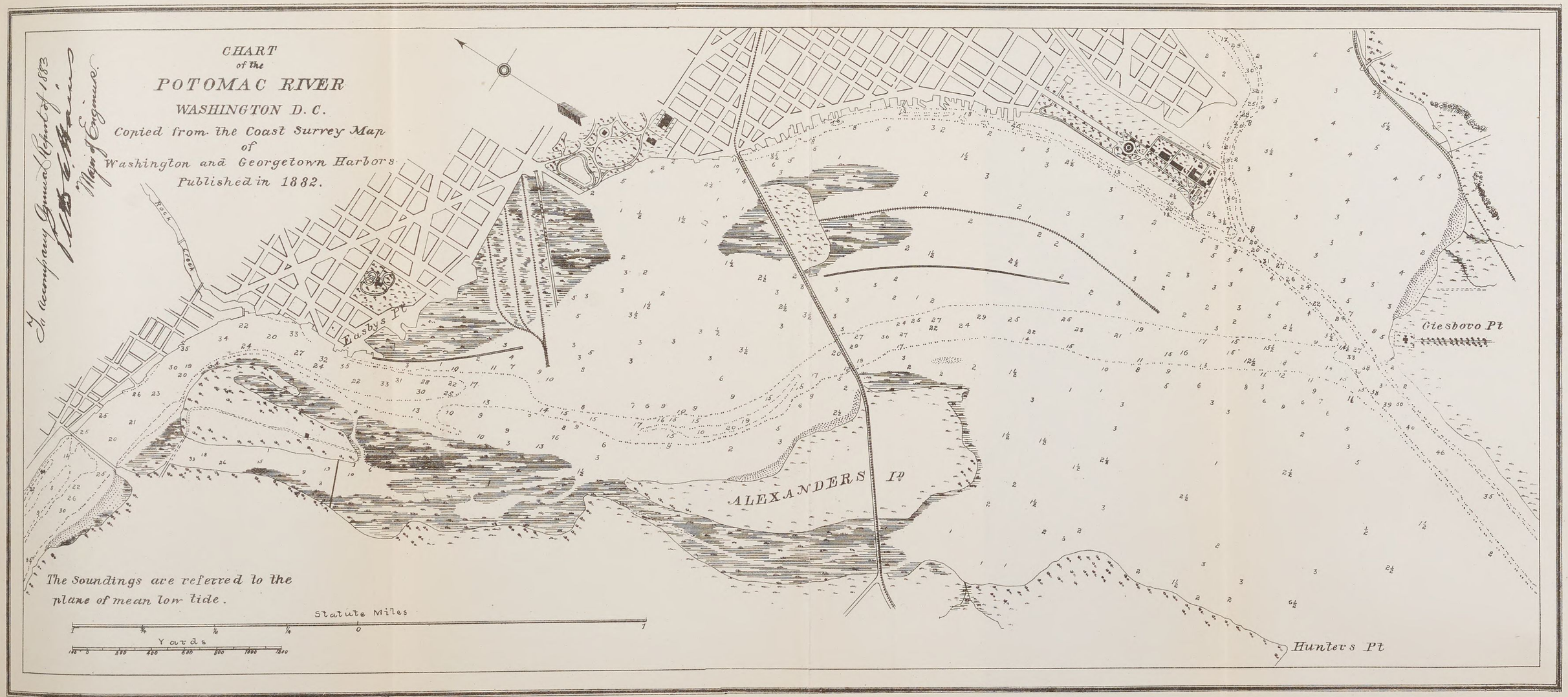
Money statement.

Amount appropriated by act passed August 2, 1882		$400,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$49,186 86	
July 1, 1883, outstanding liabilities	4,222 97	
		53,409 83
July 1, 1883, amount available		346,590 17
Amount (estimated) required for completion of existing project		2,316,365 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		1,000,000 00

Abstract of contracts for improving Potomac River in the vicinity of Washington, D. C., in force during the fiscal year ending June 30, 1883.

No.	Names and addresses of bidders.	Date of contract.	Subject of contract.	Price.	Remarks.
1	P. Sanford Rose, Jersey City, N. J.	Nov. 17, 1882	Dredging...per cub. yd..	$0 21 2/10	
2	Thomas P. Morgan, Washington, D. C.	Apr. 12, 1883	Dredging foundation..do..	7	Extended sixty days from July 1, 1883.
			Ridge.....do..	14	
3	Henry P. Gilbert, Georgetown, D. C.	Apr. 12, 1883	Riprap stone.....do..	74½	
4	Jos. A. Blundon, Washington, D. C.	Apr. 12, 1883	Brush.....per cord..	2 50	One-half of am't advertised for awarded to each.
5	George B. Chittenden, Washington, D. C.	Apr. 12, 1883	Brush.....do..	2 50	
	James T. Summers, Washington, D. C.	Apr. 12, 1883	Flat-boats (4)	3,497 44	Completed.


In accompany Report of Sept. 1883
W. E. Merrill
Major of Engineers
POTOMAC RIVER
CHART OF THE
POTOMAC RIVER
WASHINGTON D.C.
Made by M. Ellicott 1792.
APPROXIMATE SCALE
0
1/4 Mile
1/2 Mile
3/4 Mile
1 Mile.
Note
The soundings were made by Ignatius Fenwick and Richard Johns in 1791 and on the original map were referred to the plane of mean tide. That is, to a plane midway between high and low tide. In order to more readily compare this map with the latest survey the soundings have been reduced to the usual plane of reference Viz: mean low tide.


CHART
of the
POTOMAC RIVER
WASHINGTON D.C.
Copied from the Coast Survey Map
of
Washington and Georgetown Harbors
Published in 1882.
A compary Genl's Report of 1883
Maj. of Engineers
Rock Creek
Easby's Pt
ALEXANDERS Id
Giesboro Pt
Hunters Pt
The Soundings are referred to the
plane of mean low tide.
Statute Miles
Yards

Potomac River

in vicinity of

Washington D.C.

Showing the proposed improvements

in front of the City

Scale of Feet

To accompany Annual Report of 1883

Lt. Col. Engrs.

Asst. in charge

Maps of Engineer's



APPENDIX J.

IMPROVEMENT OF THE HARBORS AT BRETON BAY AND SAINT JEROME'S CREEK, MARYLAND; OF THE CHANNEL AT MOUNT VERNON, VIRGINIA; OF RAPPAHANNOCK RIVER; OF TRIBUTARIES OF THE LOWER POTOMAC, AND OF CERTAIN RIVERS IN VIRGINIA AND NORTH CAROLINA.

REPORT OF MR. S. T. ABERT, UNITED STATES CIVIL ENGINEER, IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1883, *WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

1. Channel at Mount Vernon, Virginia.
2. Neabsco Creek, Virginia.
3. Breton Bay, Leonardtown, Md.
4. Nomini Creek, Virginia.
5. Harbor at entrance of Saint Jerome's Creek, Maryland.
6. Rappahannock River, Virginia.
7. Totusky River, Virginia.
8. Urbana Creek, Virginia.
9. Mattaponi River, Virginia.
10. Pamunky River, Virginia.
11. York River, Virginia.
12. Chickahominy River, Virginia.
13. Staunton River, Virginia.
14. Dan River, between Madison, N. C., and Danville, Va.
15. Roanoke River, North Carolina.
16. French Broad River, North Carolina

UNITED STATES ENGINEER OFFICE,
Washington, D. C., August 10, 1883.

GENERAL: I have the honor to submit herewith my annual report for the fiscal year ending June 30, 1883, relating to the improvement of rivers and harbors in my charge.

Very respectfully, your obedient servant,

S. T. ABERT,
United States Civil Engineer.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

J 1.

IMPROVEMENT OF POTOMAC RIVER AT MOUNT VERNON, VIRGINIA.

HISTORY OF OPERATIONS.

A history of operations will be found, commencing on page 1003 of the Report of the Chief of Engineers for the year 1882.

A channel was completed September 15, 1881, with a width of about 145 feet and a depth of from 7 to 9 feet.

The following appropriations have been made:

March 3, 1879	$4,000
June 14, 1880	3,000
March 3, 1881	1,500

The work is in the collection district of Alexandria, which is the nearest port of entry.

The collections for the fiscal year ending June 30, 1882, were $2,695.63.

Money statement.

July 1, 1882, amount available	$57 14
July 1, 1883, amount available	57 14
Amount (estimated) required for completion of existing project	5,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	5,500 00

COMMERCIAL STATISTICS.

The following statistics of trade are furnished by Capt. J. McH. Hollingsworth, superintendent of Mount Vernon:

Dairy products	$4,800
Fish	450
Grain	2,000
Hogs	500
Lumber (sawed)	1,000
Calves	250
Poultry	150
Guano	500
Bricks	100
Supplies for Mount Vernon Association	2,000
Total	11,750

The steamer W. W. Corcoran makes daily trips to Mount Vernon, Sundays excepted. Last year she carried 18,000 visitors and 500 country passengers.

J 2.

IMPROVEMENT OF NEABSCO CREEK, VIRGINIA.

HISTORY OF OPERATIONS.

For history of operations see page 1006, Report of Chief of Engineers for the year 1882. Neabsco Creek, situated in Prince William County, Virginia, is a tributary of the Potomac River, which it enters at the lower end of Occoquan Bay, on the Virginia shore, about 28 miles below Washington, D. C.

The cut extends from the 4-foot curve in the Potomac River to the narrow part of the creek, where a sufficient depth of water exists, a distance of 5,800 feet.

The channel was completed to a width of 50 feet and a depth of 4 to 5 feet at low water.

Work was closed April 24, 1882; 23,613 cubic yards of material having been removed.

Appropriations have been made as follows:

March 3, 1881	$5,000

For the fiscal year ending June 30, 1885, an appropriation of $20,000 is recommended, if Congress desires to continue the improvement.

The work is in the collection district of Alexandria, which is the nearest port of entry. The nearest light-house is at Fort Washington.

The collections during the fiscal year ending June 30, 1882, were $2,695.63.

Money statement.

July 1, 1882, amount available	$286 67
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	229 40
July 1, 1883, amount available	57 27
Amount (estimated) required for completion of existing project	51,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	20,000 00

COMMERCIAL STATISTICS.

The following statistics of trade have been furnished by Mr. E. M. Willis, of Freestone, Prince William County, Virginia.

Hoop poles	$1,000 00
Lumber (sawed)	5,000 00
Logs	5,000 00
Railroad ties	10,000 00
Wood	10,000 00
Total	31,000 00

J 3.

IMPROVEMENT OF BRETON'S BAY, LEONARDTOWN, MARYLAND.

Breton's Bay enters the Potomac 82 miles below Washington. A history of operations to June 30, 1882, will be found commencing on page 1009 of the Report of the Chief of Engineers for the year 1882.

WORK OF THE PAST FISCAL YEAR, ENDING JUNE 30, 1883.

An appropriation of $5,000 was made August 2, 1882.
The following is an abstract of the bids opened September 20, 1882:

Abstract of proposals for improving Breton's Bay, Leonardtown, Md., opened September 20, 1882.

[For 30,000 cubic yards dredging.]

No.	Names and addresses of bidders.	Price.	Amount.	Number and kind of machines used.	Daily amount of work expected.	Date of commencement.	Date of completion.
		Per cu. yd.			*Yards.*		
1	Potomac Dredging Company, Washington, D. C.	$0 18	$5,400	One dredge.	500	October 20, 1882	June 15, 1883
2	Henry Birch, Washington, D. C.	18	5,400	One dipper-dredge.	400	October 20, 1882	June 15, 1883
3	Frank C. Somers, Philadelphia, Pa.	27	8,100	....do	500	April 15, 1883	June 15, 1883

The contract was awarded to the Potomac Dredging Company at 18 cents per cubic yard. The work was commenced November 11, 1882, and completed December 11, 1882; 16,448 cubic yards of material were removed from the channel just above and around the first bend below the town, and 5,600 cubic yards were removed from the basin, making

a total of 22,048 cubic yards. This part of the channel has a width of 120 feet and a depth of 9.5 feet. The basin at the landing is 285 feet wide for a distance of 340 feet, and contracts to 115 feet wide at a distance of 660 feet below, where it joins the steamboat channel. The channel should be widened to from 150 to 200 feet to make it permanent.

The original estimate was $30,000; of this, $20,000 has been appropriated, leaving $10,000 to be appropriated, which amount is recommended for the fiscal year ending June 30, 1885.

Appropriations have been made as follows:

June 18, 1878	$5,000
March 3, 1879	4,000
June 14, 1880	3,000
March 3, 1881	3,000
August 2, 1882	5,000

The work is in the collection district of Annapolis, which is the nearest port of entry. The collections for the year ending June 30, 1882, were $1,009.23.

The work is in the fifth light-house district, and the nearest light-house is Blakistone's Island light.

Money statement.

July 1, 1882, amount available		$3 95
Amount appropriated by act passed August 2, 1882		5,000 00
		5,003 95
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		4,987 99
July 1, 1883, amount available		15 96
Amount (estimated) required for completion of existing project		10,000 00
Amount that can be profitably expended in fiscal year ending June 3, 1885		10,000 00

COMMERCIAL STATISTICS.

RECEIPTS AND SHIPMENTS AT LEONARDTOWN, MARYLAND.

Bacon	$4,000
Beef and other cattle	7,000
Coal	5,000
Eggs and poultry	4,000
Fish and oysters	5,000
Fruits (green and dried)	5,000
Furs	1,000
Grain	50,000
Hay	2,000
Hides	3,000
Iron (bar, pig, and scrap)	1,500
Lard	2,000
Lumber (sawed) and logs ($1,000)	5,000
Potatoes	1,000
Railroad ties	5,000
Sheep and lambs	1,000
Tobacco	40,000
Wood	10,000
Wool	6,000
General merchandise	100,000
Guano	20,000
Unclassified	10,000
Total	287,500

MANUFACTURES AT LEONARDTOWN, MARYLAND.

Agricultural machines	$10,000
Agricultural implements	4,000
Castings	1,000

Corn meal	$5,000
Drugs and chemicals	2,000
Fertilizers	20,000
Flour	10,000
Furniture	1,000
Groceries	10,000
Hardware	5,000
Leather	5,000
Liquors	5,000
Wagons, carriages, &c	2,000
Woven fabrics	20,000
Merchandise not included above	2,000
Total	102,000

J 4.

IMPROVEMENT OF NOMINI CREEK, VIRGINIA.

HISTORY OF OPERATIONS.

A survey of the creek was made in November, 1872. The report, with estimate of the cost of the work, will be found in the Report of the Chief of Engineers for 1873, page 822.

Nomini Creek is an important tributary of the Potomac, which it enters about 82 miles below Washingion.

For a history of operations to the date of June 30, 1882, see Report of Chief of Engineers for 1882.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1883.

The appropriation of August 2, 1882, $2,000, was considered too small for economical work. A letter, however, from the manager of the Washingion Steamboat Company was transmitted April 19, 1883, to the Chief of Engineers, stating that in consequence of the shoaling of the channel near Ice-House Point, the steamers found difficulty in entering the creek.

Permission was asked to make an instrumental examination, which was authorized April 24.

This examination showed the obstructions to consist of shoaling about half way between White Point and White Oak Point, upon which the least depth of water is 7.3 feet.

There are also other small bars near White Oak Point upon which the water is 8.2 to 8.9 feet. These depths are often reduced by winds from the north or northwest quarters of the compass, and the bars become a serious obstruction at such periods of low water. The present appropriation may be sufficient to remove these bars, but it is too small for the widening of the channel.

It is desirable to remove about 12,000 cubic yards of material.

The money available for this work is about $1,900.

The project of August 3, 1882, recommended that the present appropriation be reserved until further increase by Congress, for the reason that it is impracticable to execute work at moderate prices with a small amount of money.

As no addition can be made, however, to the available sum within the period of a year, it would seem to be proper to yield to the wishes expressed in the letters of Mr. R. L. T. Beale, the former representa-

tive, and Mr. C. W. Ridley, the manager of the Washington Steamboat Company, desiring the removal of the obstructions above mentioned.

The work is in the collection district of Tappahannock, which is the nearest port of entry.

The collections for the year ending June 30, 1882, were $1,451.

Appropriations have been made as follows:

March 3, 1873	$10,000
June 23, 1874	6,000
March 3, 1875	5,000
March 3, 1879	2,500
June 14, 1880	5,000
March 3, 1881	2,000
August 2, 1882	2,000

Money statement.

Amount appropriated by act passed August 2, 1882	$2,000	00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	121	46
July 1, 1883, amount available	1,878	54
Amount (estimated) required for completion of existing project	18,500	00
Amount that can be profitably expended in fiscal year ending June 30, 1885	10,000	00

J 5.

IMPROVEMENT OF HARBOR AT ENTRANCE TO SAINT JEROME'S CREEK, MARYLAND.

HISTORY OF OPERATIONS.

To comply with a resolution of the Senate of December 13, 1880, an estimate was transmitted to Congress in a report dated December 16, 1880, and will be found in Appendix G 25 of Report of Chief of Engineers for 1881.

Upon this report was based the appropriation of $6,500 in the river and harbor act of March 3, 1881, for "improving the harbor at the entrance of Saint Jerome's Creek, Maryland." The object of the improvement was to make the creek accessible to the steamer of the United States Fish Commission.

Under instructions from the Chief of Engineers, dated March 26, 1881, proposals were invited for executing the work without delay.

The contract was awarded to Thomas P. Morgan, jr., the lowest bidder, at 35 cents per cubic yard for material removed on scows, and 15 cents for material deposited on sides of channel.

The channels laid out were:

(1) A channel (designated as the "outer channel") through the bar at the mouth proper of the estuary, and which was designed to be 100 feet wide and 9 feet deep at low water.

(2) A channel obliquely across the south prong of the creek, designated the "inner channel," and designed to be 40 feet wide and 6 feet deep at low water, the material from which is to be thrown upon the east side so as to build a dike for a distance of about 1,300 feet from Deep Point to a small branch which at present forms an outlet to the

Upper Pond, thus forming a new pond for the purposes of the Fish Commission. This channel is to be continued to the Upper Pond, following the general direction of the branch for a distance of about 1,200 feet.

The following are the estimates of excavation required for the outer and inner channels: For the outer channel, 100 feet wide and 9 feet deep at low water, 34,000 cubic yards. For the inner channel, 40 feet wide and 6 feet deep at low water, 14,200 cubic yards.

The annual evaporation is greater than the rainfall, and the force which must keep the new cut open is limited to the small tidal capacity of the creek.

Saint Jerome's Creek is well situated for a harbor of refuge. Its waters are adapted to the propagation of oysters.

OPERATIONS DURING THE PRESENT FISCAL YEAR ENDING JUNE 30, 1883.

Bids were invited September 20, 1882, but were rejected on account of being too high, and the work was again offered December 21, 1882.

The following table gives an abstract of bids received:

Abstract of proposals for improving Saint Jerome's Creek, Maryland (dredging), opened December 21, 1882.

No.	Names and addresses of bidders.	Cut "A," for 5,278 cubic yards.		Cut "B," for 20,000 cubic yards.		Total amount.
		Price.	Amount.	Price.	Amount.	
		Per cub. yd.		*Per cub. yd.*		
1	Daniel Constantine, Baltimore, Md.	$0 25	$1,318 00	$0 25	$5,000 00	$6,318 00
*2	Potomac Dredging Company, Washington, D. C.	50	2,639 00	50	10,000 00	12,639 00
†3	George E. Ward, Alexandria, Va....	26	1,372 28	26	5,200 00	6,572 28

No.	Names and addresses of bidders.	Number and kind of machines used.	Daily amount of work expected.	Date of commencement.	Date of completion.
			Yards.		
1	Daniel Constantine, Baltimore, Md.	One dipper dredge	500	Soon as practicable.	June 15, 1883
*2	Potomac Dredging Company, Washington, D. C.	.....do	200	Jan. 22, 1883	June 15, 1883
†3	George E. Ward, Alexandria, Va....	.....do	300	Jan. 22, 1883	June 15, 1883

*Potomac Dredging Company reserves right to deposit material as may deem practicable at Cut A. Payment to be made not later than the 10th of each month.

†George E. Ward says his bid is contingent upon the award of contracts for Urbana Creek and Rappahannock River, Virginia; proposals opened on same date.

The bid of Daniel Constantine, 25 cents per cubic yard, being the lowest, was accepted.

The inner channel was laid out and the bank was marked with slope and grade stakes from Deep Point to the Fish Commission Wharf, in the upper pond, 3,050 feet distant.

In the first section, for a distance of 1,470 feet, nearly all the excavation is deposited in a bank, on the left of the cut, and in the second section, for a distance of 1,580 feet, the excavation is deposited on each side. The average width of the cut in the first section is about 32 feet,

in the second section it is about 28 feet, the depth in each section being 6½ and 5 feet below low water.

It was expected that the sides would assume the slope of 3 to 1 immediately after dredging, and that the bottom width would vary from 15 feet in the first section to 10 feet in the second section.

After consultation with the Assistant Fish Commissioner, it was determined to penetrate, by means of a narrow cut, to the upper pond, and afterward to make any necessary enlargement with such appropriations as Congress might subsequently grant.

The work was completed June 22, 1883, 15,526 cubic yards having been dredged from the two sections.

The following appropriations have been made:

March 3, 1881	$6,500
August, 2, 1882	5,000

I respectfully recommend an appropriation of $15,000 for the fiscal year ending June 30, 1885, if the work is to be continued.

A map of Saint Jerome's Creek, showing the condition of the work at the close of the fiscal year ending June 30, 1883, accompanies this report.

The work is in the collection district of Annapolis, which is the nearest port of entry. The nearest light-house is Point Lookout, in the fifth light-house district.

The collections for the year ending June 30, 1882, were $1,009.29.

COMMERCIAL STATISTICS.

The trade is chiefly in oysters. No statistical returns have been received.

Money statement.

Amount appropriated by act passed August 2, 1882		$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		4,872 26
July 1, 1883, amount available		127 74
Amount (estimated) required for completion of existing project		15,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		15,000 00

J 6.

IMPROVEMENT OF RAPPAHANNOCK RIVER, VIRGINIA.

HISTORY OF THE IMPROVEMENT.

The Rappahannock River, from Fredericksburg, the head of navigation, to Chesapeake Bay, is 104 miles in length.

1852. The first reconnaissance of which we have any knowledge was made in 1852, by Capt. Joseph F. K. Mansfield, Corps of Engineers. His estimate for improving the river to accommodate the trade of that period amounted to $40,000. This was intended simply for dredging bars, and not for their permanent improvement. No work was done at that time. (See Report of the Chief of Engineers for 1874.)

1870–1871. The survey for the improvement was made in November, 1870. The report will be found in the Report of the Chief of Engineers for 1874, Part II, page 31. It was proposed to dredge a channel 10 feet deep and 100 feet wide through the bars at Fredericksburg, Spotts-

wood, Castle's Ferry, Farleyvale, Nanzatico Reach or Port Tobacco, and Naylor's Hole, and also to remove certain wrecks found at Piscat-*away* and Urbana creeks, and at Lawrie's Point and Mill Creek. The estimate amounted to $83,760. No work for the permanent improvement of the river or the preservation of this depth was included in this estimate. (See Report of the Chief of Engineers for 1874, Part II, page 33.) The several appropriations for improvement, and the work done under them (full details of which will be found in the annual reports for the years mentioned below), are summarized as follows:

March 3, 1871, $15,000. Under this appropriation channels 70 feet wide and 8 feet deep at low water were dredged by contract through Spottswood and Fredericksburg bars, and completed September, 1872. Wrecks were removed by contract, as follows: One at Fredericksburg, one at Spottswood Bar, one at Piscataway Creek, one at Urbana, one at Lawrie's Point, and two at Mill Creek. The sum allotted was insufficient to dredge a channel of the dimensions proposed.

A small longitudinal dike was constructed at Fredericksburg, for the purpose of contracting the channel, but chiefly to supply a recess for the deposition of the material.

1872. On June 10, $15,000 was appropriated. It was found necessary to redredge the channel at Fredericksburg. It was observed that "the tendency of the river bed to return to its original condition still continued to exist, and that all that could be expected from the expenditure of the small sum at the command of the engineer was to keep the river in a navigable condition for the ensuing season."

The sum of $65,000 was stated to be sufficient to complete the work according to the original plan. Thus it will be seen that the small appropriations had already increased the cost of the work.

In the report for this year the engineer proposed to limit his operations to simply keeping the navigation open, and asks for an appropriation of $15,000, one-half of which he proposes to apply to redredging the Fredericksburg channel, the balance to be held in hand for the removal of deposits which were likely to be made by the freshet of the following spring. The channels at Fredericksburg and Spottswood bars were widened to 120 feet, and completed in April, 1873. A dike 1,600 feet long was built along the left bank of the river opposite Fredericksburg to confine the dredged material placed behind it, and to contract the water-way of the stream over the bar. A dike was also constructed along the right bank, below the steamboat wharf, to rectify the wharf-line, and filled with dredged material.

1873. March 3, 1873, $15,000. A freshet of unusual duration and height occurred in May, 1873, which caused some filling in the Fredericksburg Channel. The channel was again redredged at Fredericksburg and at Spottswood to the depth of 8 feet. The material was deposited behind the dikes and in the river below the bar. This work was concluded in November. The dike on the left bank was extended and connected with the shore.

Several logs and snags were removed below Spottswood Bar. The work was transferred to my charge in July, 1874. Little advance had been made in securing the depth dredged, and the money was, as heretofore, expended in keeping open the navigation. The scouring of the current, resulting from the dikes, began to move the surface of the bars, but was still insufficient.

1874. Redredging the channel was again necessary. Some logs were removed from Spottswood Bar. In the Report of the Chief of Engi-

neers for this year will be found Mr. Hutton's report of an estimate for improving the river. The estimate amounted to $83,760.

The expenditures were continued upon the same general plan. The difficulty of securing dumping-ground had made a small encroachment upon the tidal area necessary, and it now became important to limit any further occupation of this tidal space.

The fluvial character of the river at Fredericksburg was believed to be sufficient to compensate for the occupation of a small tidal space as a dumping-ground.

June 23, 1874, $7,000. The available balance July, 1874, including this appropriation, was nearly $13,000. A dike was built by contract on the left bank of the river, between the railroad bridge and the ferry, and completed March 8, 1875. The channel was dredged along the wharf front, where it was found to have filled in. The sand was placed behind this dike (No. 2) and the channel completed 50 feet wide and 9 feet deep at low water July 28, 1875.

1875. A resurvey of the bar at Fredericksburg showed that the cut of the previous year had been almost obliterated. The material which formed the bar consisted of a bed of sand 6 feet deep and more than a mile long, and appeared to be slowly moving down the stream and receiving annual accretions from the freshets. To remove this bar permanently it was evident that it must be vigorously attacked, and for this purpose a sum of money must be held in hand to again attack the bar, which would be re-formed lower down.

In the report of 1874 it was stated that $52,000 had been expended, and that $44,000 would still be needed, which might be sufficient to complete the work, if appropriated in one sum. If the navigation was to be kept open by small appropriations, as heretofore, the engineer recommended that $7,500 be appropriated annually for that object.

March 3, 1875, $5,000. Applied to re-dredging the channel between Deep Run and the lower wharves, as far as the funds permitted, the width being 50 feet and the depth 9 feet. The material was deposited behind the dike (No. 1) and the work concluded May 8, 1876.

1876. The small appropriations made the work of this year a repetition of the previous one.

August 14, 1876, $10,000. This appropriation was made available January 22, 1877.

The dike built in 1872 on the right bank, below the steamboat wharf, had been injured by ice and was in danger of giving way and precipitating the sand behind it into the channel. A new dike (No. 3) was therefore built outside of it and so as to improve the line of the wharf front. This was done by contract, and completed June 12, 1877. The channel was also dredged between the steamboat wharf and Deep Run, 50 feet wide and 9 feet deep, the contract being concluded July 26, 1877. Full details of the operations, briefly summarized, will be found in the several annual reports of the years mentioned.

1877. The work of keeping open navigation and of making an extension of the dikes occupied this year. This work was done under the appropriation mentioned in the last paragraph, in which the operations are also described.

1878. June 8, 1878, $13,500. This appropriation was applied to building dikes and dredging at Fredericksburg Bar. Two dikes were built (No. 4) between the lower end of the city wharves and Hazel Run, and (No. 5) on the left bank of the river (below Dike No. 1).

The work was done by contract; commenced September 27, 1878, and completed September 20, 1879. The dredging included the excavation

of a channel along Dike No. 4, the removal of the bar at the steamboat wharf, and the basin at this point for turning steamers. The work was done by contract, having been commenced November 25, 1878, and completed April 9, 1879. The sand dredged from the river was placed behind Dikes 1, 3, and 4.

About the close of this year, 1878, the citizens of Fredericksburg began to manifest an interest in the improvement. The general depth had been increased, and an increase of trade was apparent.

In my letter dated October 16, 1878, addressed to the Chief of Engineers, it is stated that the effect of a sudden removal of the bar at Fredericksburg would be to build other bars lower down the river. The Fredericksburg Bar had been gradually disappearing, and at this date, October, 1878, the depth was permanently increased from 1 to 2 feet.

1879. As had been anticipated, the re-formation of the bars below Fredericksburg began to be manifest. A small bar had formed temporarily below the steamboat-wharf, and the steamboats began to find difficulty in passing Pollock's, Barnard's, and Pratt's bars, two of which had been previously almost unknown.

Spottswood Bar began again to be troublesome. Throughout the Fredericksburg Reach, however, a general improvement was apparent. At this time it was deemed advisable to revise the original estimate. An estimate was, therefore, made with a view of giving a channel 10 feet deep as far down as Port Royal, and from thence to the mouth of the river, which is navigated by a larger class of vessels, the channel was estimated at a depth of 15 feet at low water. The amount of the estimate was $291,000 in round numbers. This did not include the $95,000 which had been expended in giving a depth of 8 feet at low water. This depth had no doubt been attained for a short period.

The last estimate, $291,000, is based upon the maps of the Coast Survey and upon reconnaissances since made, and will, I think, be sufficient to complete the work, if liberal appropriations are made.

Before commencing operations at any locality, an accurate determination of extreme low water and a careful survey will be necessary. The relative amount of diking and dredging, and the material and plan of construction of the dike, can then be exactly determined. At present the estimate is approximately correct.

At the localities where the dikes will be exposed to salt water it may be necessary to employ creosoted timber or some material not subject to the action of the teredo.

The estimate will be found at the close of this report in a tabular form.

The operations of this year consisted in removing snags and a dangerous piece of wreck at Spottswood Bar, in planting the areas inclosed by the dikes at Fredericksburg with willows, and in building a spur-dike of crib work opposite the steamboat landing.

March 3, 1879, $10,000. This appropriation was made available June 5, 1879.

Dike No. 6, at Fredericksburg Bar, 605.5 feet long, was built by contract, for the protection of the bank below Hazel Run, and a crib-dike 80 feet long was built by hired labor. This dike is nearly opposite the steamboat wharf, and was designed to reduce the water-way and preserve the depth that had been obtained by dredging.

At Spottswood Bar fifteen spur-dikes, of an aggregate length of 2,046.6 feet, were built by contract.

The work under this contract, which included Dike No. 6, at Fredericksburg Bar, was commenced March 1, 1880, and completed December 23, 1880.

The shore connections of the dikes were protected from the erosive action of freshets by cushions of brush staked down to the banks. The entire reach in which Spottswood Bar occurs was examined, and fifty snags, six drift-logs, and one small wreck were removed.

Although begun and completed in 1880, the work was done under the appropriation of 1879.

1880. In the spring of this year Dike No. 6 was completed at Fredericksburg, and before the close of the year fourteen spur-dikes, chiefly in pairs, were constructed at Spottswood Bar. One of these dikes on one side of the river had a deflecting wing, and another had a longitudinal wing to control the confluence of a small branch.

June 14, 1880, $25,000. Under this appropriation dikes were built by contract, as follows: At Fredericksburg Bar, crib-dike "M," opposite the steamboat wharf, was extended 100 feet. Eight spur-dikes and one deflecting dike were built to contract the channel, and a retaining dike was built to close a part of the ferry landing. A dike for protecting the shore between Hazel Run and Deep Run and preserving the contraction of the water-way was also constructed.

At Spottswood Bar four additional spur-dikes were built to complete the original project at that locality.

The work was commenced February 7, 1881, and completed October 22, 1881; the length of the dikes built being 2,702 feet at Fredericksburg, and 466.5 feet at Spottswood Bar; total, 3,168.5 feet.

Under the same appropriation a contract was made for dredging both at Fredericksburg and Spottswood bars, and the work commenced April 12, 1881.

Under this contract 20,187 cubic yards of material were removed from the basin in the harbor of Fredericksburg, and 41,821 cubic yards from the channel at Spottswood Bar, giving a channel 11 feet deep at low water and from 46 feet at the upper end to 70 feet in width at the lower end.

A part of the above work falls within the fiscal year ending June 30, 1882, and is described below.

In the spring of 1880 the bar at Spottswood, under the scouring action of the current caused by the dikes, had ceased to exist. The system, however, was incomplete, and four new dikes were constructed. The channel was made uniform by dredging, and the effects of the dikes was supplemented by dumping the material between them and up to the level of low water.

DIKES.

1881 and 1882. A statement in the report of 1882 shows the designation, height, length, and character of the dikes built under the contract with Mr. Kishpaugh, dated December 6, 1880. With the exception of Dike M, all the dikes are built of piles and sheet-piling.

Twelve dikes were built at Fredericksburg and four at Spottswood Bar. These dikes are described more minutely in the report for 1882, pages 1019, 1020, and 1021.

Previous to December, 1881, the dikes built on the river had been constructed by contract.

The pile-driver formerly used by the contractor, Mr. Kishpaugh, was offered for sale, and after estimates of its value had been made, was purchased for the sum of $600 on December 20, 1881.

Temporary dikes were built projecting from Dike No. 1, so as to reduce the width of the river to 275 feet. The piles for these dikes were driven so that they could be subsequently used for more permanent

dikes, if these should be needed. The face of the dikes was formed by panels of 1-inch boards, securely fastened together and built in sections, so that the length of the dike could be varied as the action of the current might make necessary. These dikes were intended to secure scouring action on the bar during the prevalence of the winter and spring freshets, and they still answer the purpose for which they were constructed.

An additional spur dike of crib-work, designated as Dike O, was also built about midway between Dike M and Dike No. 1. In continuation of the general project, an additional spur dike (designated as Dike N) was also built opposite the steamboat wharf, projecting from the left bank of the river.

On April 1, 1882, all the dikes which were then deemed necessary at Fredericksburg Bar had been completed. Operations were commenced at Pollock's Bar, the next bar below Fredericksburg and about half a mile from the railroad bridge. The project for improving this bar includes the dredging of the channel 100 feet wide and 10 feet deep at low water and the construction of three spur-dikes, projecting from the right bank of the river. The construction of these dikes was commenced April 5, 1882.

The upper dike, No. 1, was a crib-dike, 80 feet in length and 5 feet above low water. It was built of oak and pine logs and filled with stone.

Dike No. 2 was also built of crib-work and filled with stone and was 100 feet in length.

Dike No. 3 was built of piles and logs, the piles being driven in pairs and logs laid between them abutting closely, so as to form a continuous wall. Its length is 100 feet.

Four snags were removed, having a total length of 145 feet and from 10 to 30 inches in diameter. The construction of the dikes was commenced June 1, 1882, and was completed at the close of the fiscal year.

The construction of 19 wing-dams at Spottswood Bar, supplemented by the dredging operations, has removed the difficulties of navigation at this point. Recent examinations show the channel to have preserved its depth, but it should be still further widened, in accordance with the original project, to at least 100 feet.

DREDGING.

On June 30, 1881, dredging was in progress at Spottswood Bar, under the contract with Mr. Henry Birch, of Washington, D. C., dated December 10, 1880. The total amount of material removed at Spottswood Bar was 41,842 cubic yards.

Having concluded the work at Spottswood Bar, the contractor transferred his machines again to Fredericksburg Bar, and completed the dredging in this locality. His operations were brought to a close on December 3, 1881, when a basin 260 feet long, 250 feet wide, and from $10\frac{1}{2}$ to 11 feet deep at low water, had been dredged. The total amount of dredging at Fredericksburg, under the contract, was 20,187 cubic yards. Total under this contract, both at Fredericksburg and Spottswood, was 62,008 cubic yards.

WORK DURING PRESENT FISCAL YEAR ENDING JUNE 30, 1883.

At Fredericksburg 1,310 linear feet of dike No. 5 were removed to low water in order to restore the tidal space to the river, and three ex-

tension dikes were constructed to connect the panel dikes E, F, and G with the shore. The removal of 1,310 feet cost $98.34, and the extension cost $2.33 per linear foot.

The panels were repaired, and 37 fender piles were driven 9 feet to a bed of rock at a cost of $3.91 per pile.

Longitudinal Dike K was connected by a crib-dike with the shore to supply a receptacle for dredged material; cost, $165.01, or $5.50 per linear foot.

At Bernard's Bar deflecting log dike, 155 feet in length, was constructed at a cost of $3.85 per linear foot. The cost of the dike was increased by the necessity of depositing stone at its base.

Several panels at Pratt's Bar were repaired with logs and sand bags at a cost of $64, and mattresses were sunk at Pratt's and Pollock's bars at a cost of $76.50

At Spottswood Bar 170 linear feet of wattling were built and four snags were removed at a total cost of $60, and a mattress was sunk along front of No. 33 at a cost of $5.50.

At Castle's Ferry Bar six log dikes were constructed at $2.80 per linear foot. These dikes were 183, 224, 220, 224, 185, and 134 feet long.

At Farleyvale two log dikes, with crib extensions upon the shore, were constructed. The log dikes were 190 and 181 feet long, and the crib extensions were 85 and 81 feet. The cost of the former was $2.94 per linear foot; the latter $2.22 per linear foot. It may be necessary to construct one or more dikes at this point.

The following tabular statement mentions all the dikes constructed during the year.

Condensed tabular report on diking by hired labor, from the 1st of July to the 1st of December, 1882.

Designation.	Locality.	Date of construction.	Length.	Height above low water.	Method of constructing.
			Feet.	*Feet.*	
Three log dikes..	Fredericksburg Bar.	July 1 to 31	95 139 150	5	Log panels.
Six log dikes	Castle's Ferry Bar..	August 9 to September 28.....	224 185 134 183 224 220	5	Do.
Two log dikes ...	Farleyvale Bar	September 29 to October 6	190 181	5	Do.
Two crib-dikes ..	.....do.....	September 29 to October 6	85 81	5	Crib-dikes filled in with brush, sand, and stone.
One log dike.....	Bernard's Bar	November 22 to December 13 ...	155	4	Log panels.

DREDGING.

Under the same appropriation, August 2, 1882, of $17,000, it was proposed to dredge, if the funds would permit, the shoalest bars between Fredericksburg and Farleyvale. The sum assigned to pay for dredging was about $12,000.

The proposed cut was to be 10 feet deep at low water, and the width 70 to 75 feet. It was believed that 52,400 cubic yards could be removed.

The following table exhibits the quantities proposed to be dredged, which quantities may be modified subsequent to the letting.

Locality.	Distance of head of bar below Fredericksburg steamboat wharf.	Depth of cutting.	Kind of material is believed to be—	Deposit between or near spur-dikes, or in rear of longitudinal dikes.		
				Estimated quantity.	Estimated average distance of transportation.	Estimated depth of dumping-ground below low water.
	Miles.	*Feet.*		*Cu. yds.*	*Feet.*	*Feet.*
Fredericksburg Bar	0	0 to 5½	Mostly sand and mud with some gravel.	37,400	750	0 to 8
Pollock's Bar.....	1.1	0 to 3½	.....do	3,860	300	0 to 7
Bernard's Bar	1.7	0 to 2	Sand, mud, and gravel	2,500	400	0 to 7
Pratt's Reach	3.2	0 to 2¾	Sand and mud	5,500	400	0 to 4
Spottswood Bar	3.9	0 to 3	Mostly sand and mud with some gravel.	14,000	400	0 to 3
Castle's Ferry Bar.....	7.8	0 to 3	Sand and mud.....	7,067	450	0 to 6½
Farleyvale Bar	12.3	0 to 3½	Sand, mud, and gravel	4,064	400	0 to 7

The funds being small, no dredging was to be done at Bernard's, Pratt's, or Spottswood bars, unless a small surplus might remain.

The following abstract gives all the bids received for the above-mentioned work on December 21, 1882:

Abstract of proposals for improving Rappahannock River, Virginia, opened December 21, 1882.

[For 100,000 cubic yards dredging.]

No.	Names and addresses of bidders.	Price per cubic yard.	Amount.	Number and kind of machines used.	Daily amount of work expected.	Date of commencement.	Date of completion.
					Cu. yds.		
1	Daniel Constantine, Baltimore, Md.	$0 21	$21,000	One or more dipper-dredges.	500	January 22, 1883.	June 15, 1883
2	*Potomac Dredging Company, Washington, D. C.	†19½ ‡24	17,940 1,920	Two or more dipper-dredges.	600	January 22, 1883.	June 15, 1883
		.....	19,860				
3	§Isaac R. Bowen, Georgetown, D. C.	23⅞ 24	23,875 24,000	One or more dredges.	350	Soon as practicable.	June 15, 1883
4	‖George E. Ward, Alexandria, Va.	26	26,000	Two or more dipper-dredges.	600	Soon as practicable.	June 15, 1883.
5	Henry Birch, Washington, D. C.	21	21,000	One or more dipper-dredges.	500	January 22, 1883.	June 15, 1883

*Potomac Dredging Company, for material excavated and deposited at or near spur-dikes, or over longitudinal dikes, 19½ cents per cubic yard. For material excavated and deposited in rear of longitudinal dikes not exceeding a distance of 100 feet, 24 cents per cubic yard. Scow measurement. Payment to be made not later than the 10th of each month.

†For 92,000 cubic yards.

‡For 8,000 cubic yards.

§Isaac R. Bowen says he will do the work for 23⅞ cents per cubic yard if awarded the contracts for Saint Jerome's Creek, Maryland, and Urbana Creek, Virginia. Proposals opened same date.

‖George E. Ward says his bid is contingent upon the award to him of the contracts for Saint Jerome's Creek, Maryland, and Urbana Creek, Virginia.

The bid of the Potomac Dredging Company being informal, the contract was awarded to Daniel Constantine, of Baltimore, Md., at 21 cents per cubic yard.

DREDGING IN 1883.

Fredericksburg.—Work was begun on the bar at Fredericksburg May 19 and completed June 5. Beginning at the lower end of the bar at Hazel Run a channel 75 feet wide was made for the distance of 2,400 feet; from thence of 70 feet wide for a distance of 2,250 feet to the upper end of the basin at the steamboat wharf; and from thence to the upper end of Phillips' Wharf, a distance of 450 feet, it is 45 feet wide. The average depth is 10 feet. The basin is 230 feet wide. The total amount of excavation is 39,630 cubic yards.

All the material excepting 500 cubic yards has been deposited between the spur-dikes, to a height of about 0.50 foot above low water.

Pollock's Bar.—Work commenced May 19 and was completed May 29. A channel 80 feet wide, 10 deep, was excavated and 5,403 cubic yards were removed. All the material was deposited to a height of 0.50 foot above low water between the spur-dikes.

Castle Ferry Bar.—Work commenced June 8 and was completed June 29. A channel 1,600 feet long and 10 feet deep was excavated; 7,274 cubic yards of material were removed and placed between the spur-dikes.

The machine was transferred at the beginning of the fiscal year, July 1, 1883, to Farleyvale.

ESTIMATE.

In the Report of 1881 will be found an estimate (see page 963) for dredging the bars, which reformed at new positions, or had extended their dimensions in former positions between Fredericksburg and Farleyvale. The total of the estimate amounted to $48,745. It covered the cost of dredging upon Pollock's, Bernard's, and Pratt's bars, two of which had been previously unknown, their formation showing conclusively that the material of the Fredericksburg Bar had been transferred to the lower part of the river. This result had been anticipated and was provided for in the plan of permanent improvement, which was to force the bars to lower and deeper reaches of the river, where they would be more manageable.

This estimate ($48,745) was intended as part of the estimate of 1880 ($291,000). It was inserted as an explanation of the request for an appropriation of a larger amount than had been previously granted. The necessity of liberal appropriations to secure economy of execution is well known, and I would recommend an annual appropriation of $50,000 for this object.

The estimate of 1879 is repeated below in a tabular form, with the appropriations since made.

In the same report (1881, page 693) is printed a tabular statement of the depths observed upon certain named bars between Fredericksburg and Farleyvale, during examinations made, first, by an officer of the Coast Survey, in 1856; second, by Colonel Craighill, in 1870; and third by myself, in 1881. The depth on the bars was found to vary at each of these periods.

In what cases the difference in the low-water depth is due to a difference in the point of sounding, or to a change in the position or size of the bar, or to the assumption of a different plane of reference for the reduction of the soundings can only be determined after further observation.

The result, however, clearly indicated the importance of careful observation for the purpose of determining the plane of extreme low water before establishing the plane to which the improvement will be finally referred.

GENERAL ESTIMATE OF COST OF COMPLETING IMPROVEMENT OF RAPPAHANNOCK RIVER, VIRGINIA, BASED UPON RECOMMENDATIONS AND SURVEYS.

FREDERICKSBURG BAR.

100,000 cubic yards of dredging, at 25 cents	$25,000
2,500 linear feet wing-dams, at $4	10,000
	35,000
Contingencies, 10 per cent	3,500
Total	38,500

SPOTTSWOOD BAR.

40,000 cubic yards of dredging, at 25 cents	$10,000
1,000 linear feet wing-dams, at $4	4,000
	14,000
Contingencies, 10 per cent	1,400
Total	15,400

CASTLE'S FERRY BAR.

20,000 cubic yards of dredging, at 25 cents	$5,000
1,300 linear feet wing-dams, at $4	5,200
	10,200
Contingencies, 10 per cent	1,020
Total	11,220

MOSS NECK REACH.

17,000 cubic yards of dredging, at 25 cents	$4,250
1,000 linear feet wing-dams, at $4	4,000
	8,250
Contingencies, 10 per cent	825
Total	9,075

FARLEYVALE REACH.

14,500 cubic yards of dredging, at 25 cents	$3,500
1,500 linear feet wing-dams, at $4	6,000
	9,500
Contingencies, 10 per cent	950
Total	10,450

NANZATICO REACH.

200,000 cubic yards of dredging, at 15 cents	$30,000
4,000 linear feet wing-dams, at $2.50	10,000
	40,000
Contingencies, 10 per cent	4,000
Total	44,000

NAYLOR'S HOLE.

860,000 cubic yards of dredging, at 15 cents	129,000
6,000 linear feet wing-dams, at $3	18,000
	147,000
Contingencies, 10 per cent	14,700
Total	161,700

Aggregate of estimate of 1879, including contingencies		290,345
Deduct appropriations of June 14, 1880	$25,000	
Deduct appropriations of March 13, 1881	15,000	
Deduct appropriations of August 2, 1882	17,000	
		57,000
Not yet appropriated		233,345

This estimate is intended to cover the cost of the construction of sheet-pile dikes similar to those built at Spottswood Bar. These dikes, it is believed, will be sufficient to accumulate the sand in which they will be buried soon after completion. It seems unnecessary to provide for the construction of more expensive dikes until time shall demonstrate whether they will be needed. It will then be found that but a small part of these dikes will have to be reconstructed.

A general map of the Rappahannock River between Fredericksburg and Farleyvale; and also special maps of Fredericksburg, Pollock's, Castle's Ferry, and Farleyvale bars, showing their condition at the close of the fiscal year ending June 30, 1883, accompany this report.

APPROPRIATIONS MADE.

The following appropriations have been made and expended under the former project:

March 3, 1871	$15,000
June 10, 1872	15,000
March 3, 1873	15,000
June 23, 1874	7,000
March 3, 1875	5,000
August 14, 1876	10,000
June 18, 1878	13,500
March 3, 1879	10,000

The following appropriations have been made under the present project:

June 14, 1880	$25,000
March 3, 1881	15,000
August 2, 1882	17,000

The work is in the collection district of Tappahannock, which is the nearest port of entry. The nearest light-house is Bowler's Rock, in the fifth light-house district.

The collections for the year ending June 30, 1882, were $1,451.05.

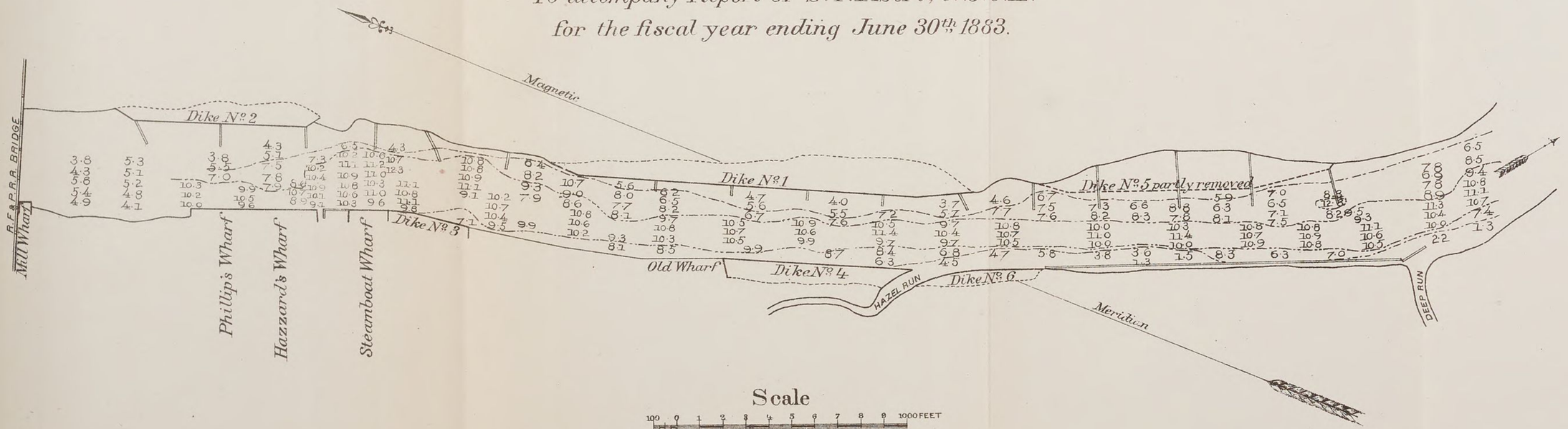
Money statement.

July 1, 1882, amount available		$5,425 74
Amount appropriated by act passed August 2, 1882		17,000 00
		22,425 74
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$19,044 76	
July 1, 1883, outstanding liabilities	876 31	
		19,921 07
July 1, 1883, amount available		2,504 67
Amount (estimated) required for completion of existing project		233,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		50,000 00

RAPPAHANNOCK RIVER
VIRGINIA
at
Fredericksburg Bar

Showing Condition in June 1883.

To accompany Report of S.T. Abert, U.S.C.E.
for the fiscal year ending June 30th 1883.



Scale

100 0 1 2 3 4 5 6 7 8 9 1000 FEET

The soundings are expressed in feet and show the depth at Mean Low Water, the plan of reference

The 6 feet curve is represented thus ~~~~

" 9 " " " ~~~~

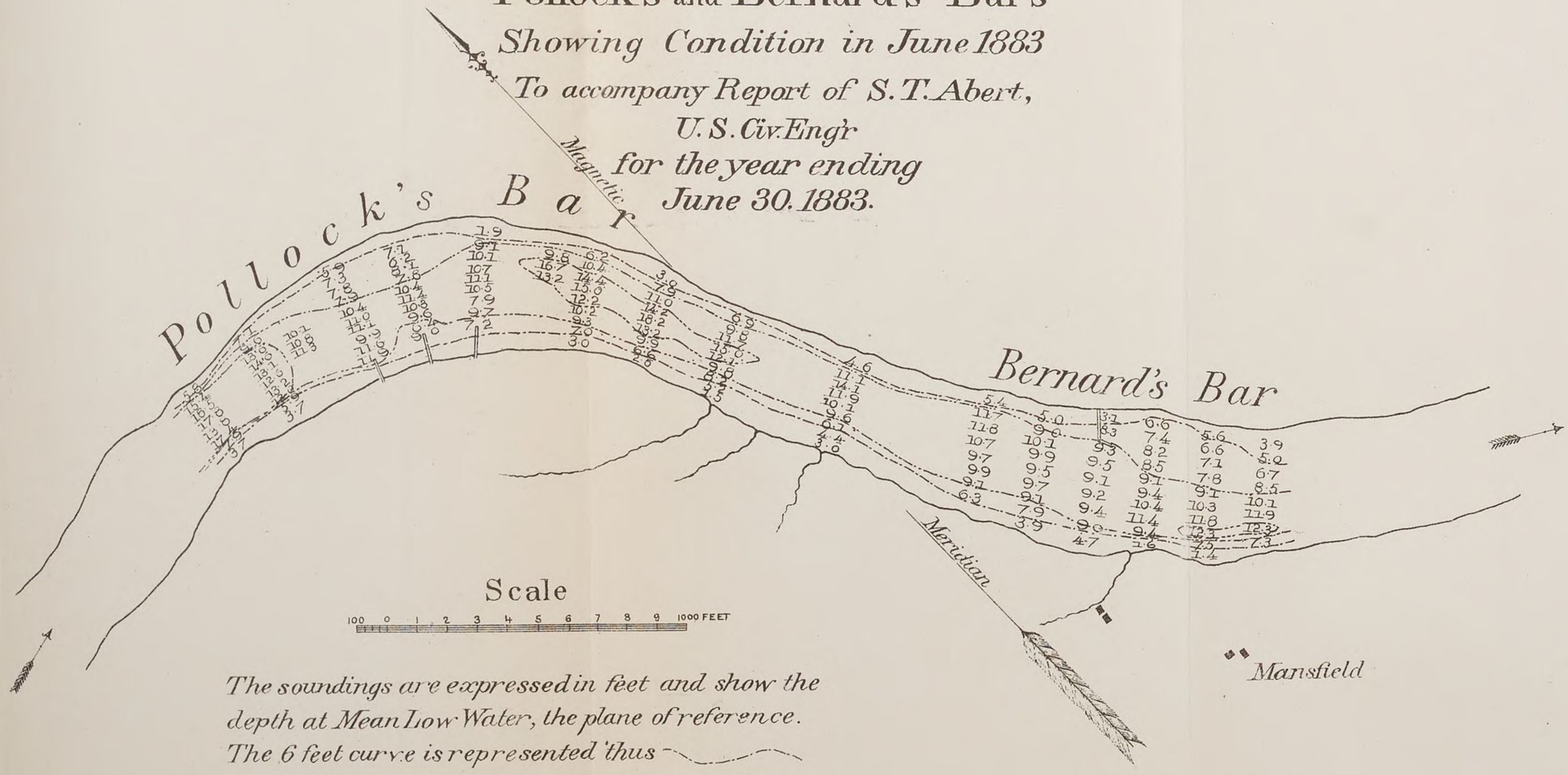
" 12 " " " ~~~~

Drawn by M. Hendges

RAPPAHANNOCK RIVER
VIRGINIA
at
Pollock's and Bernard's Bars

Showing Condition in June 1883

To accompany Report of S. T. Abert,
U. S. Civ. Engr
for the year ending
June 30. 1883.



The soundings are expressed in feet and show the depth at Mean Low Water, the plane of reference.
The 6 feet curve is represented thus ~~~~
" 9 " " " " " ~~~~
" 12 " " " " " ~~~~

RAPPAHANNOCK RIVER

VIRGINIA

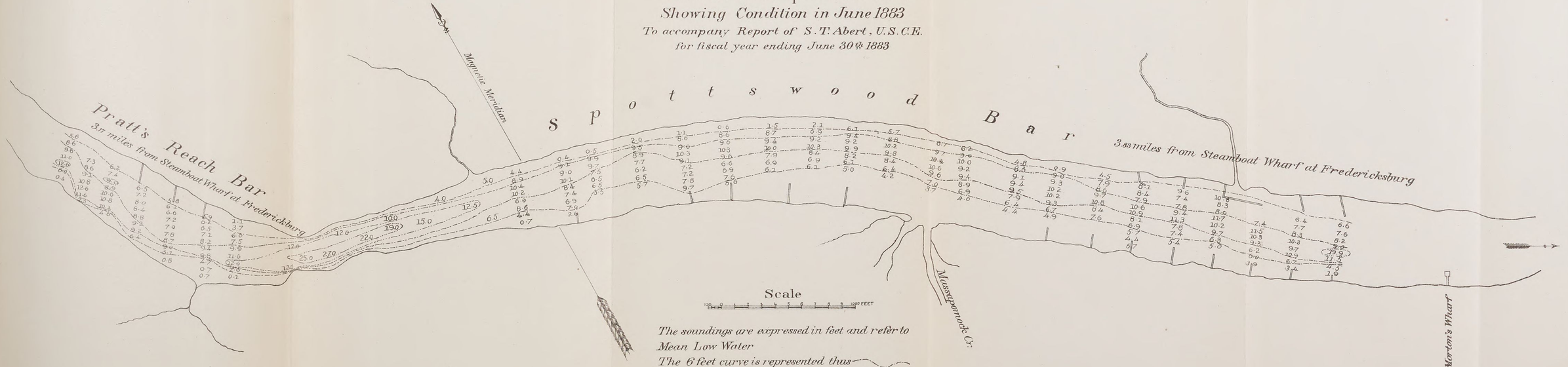
at

Pratt's Reach and Spottswood Bars

Showing Condition in June 1883

To accompany Report of S. T. Abert, U.S.C.E.

for fiscal year ending June 30th 1883



The soundings are expressed in feet and refer to Mean Low Water

The 6 feet curve is represented thus

" 9 " " " " "

" 12 " " " " "

" 18 " " " " "

RAPPAHANNOCK RIVER

VIRGINIA

at

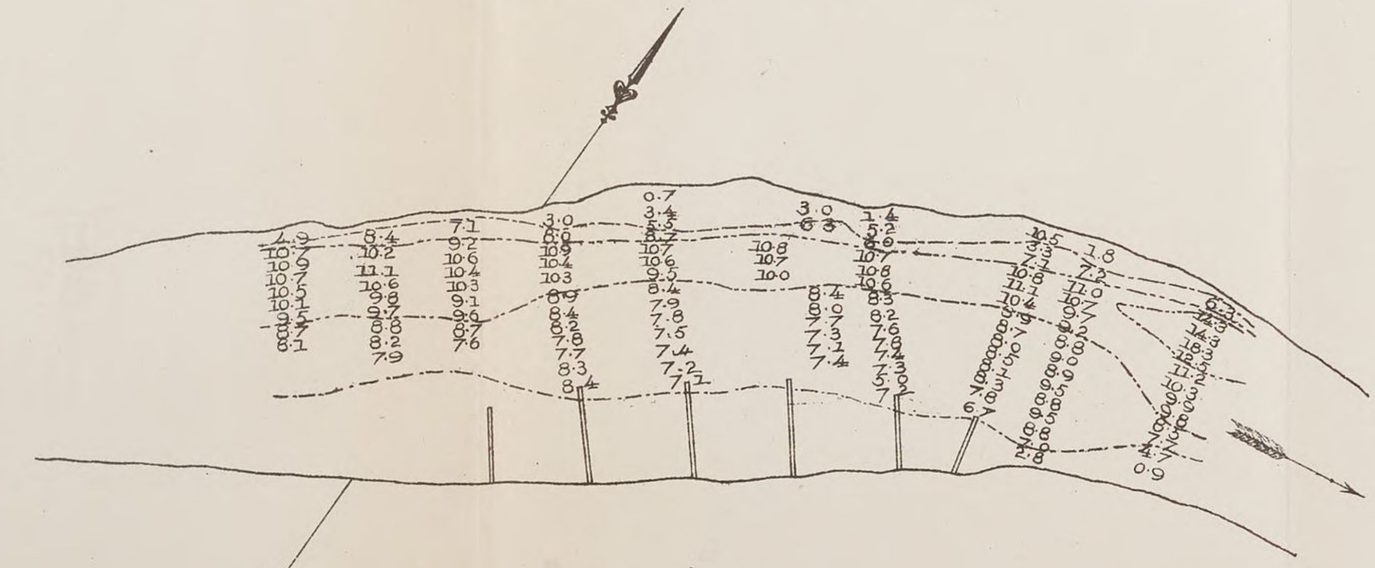
Castle's Ferry Bar

(7.78 miles from Steamboat Wharf at Fredericksburg)

Showing Condition in June 1883

To accompany Report of S. T. Abert, U.S.C.E.

for fiscal year ending June 30th 1883



Scale

100 0 1 2 3 4 5 6 7 8 9 1000 FEET

The soundings are expressed in feet and show the depth at Mean Low Water, the plane of reference.

The 6 feet curve is represented thus

" 9 " " " " "

" 12 " " " " "



RAPPAHANNOCK RIVER

VIRGINIA

at

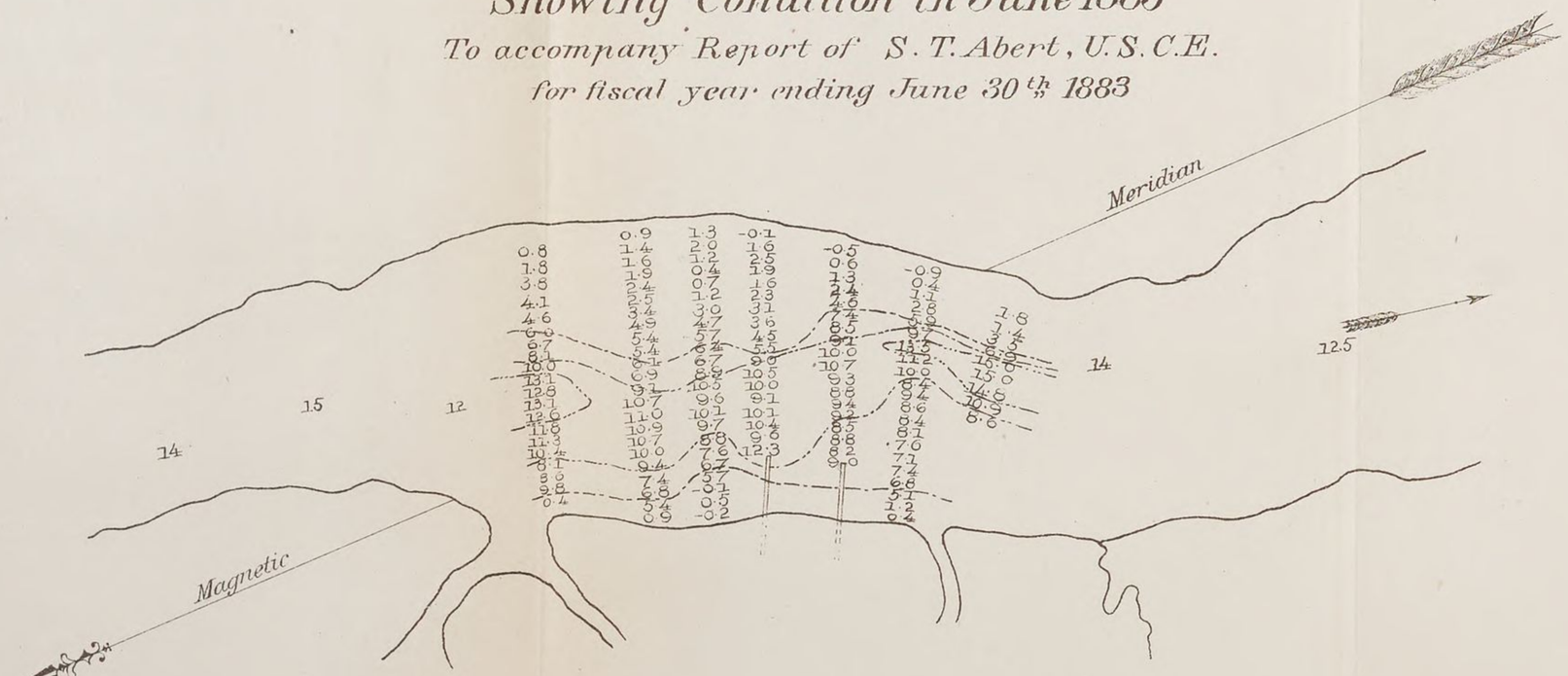
Farleyvale Bar

(12.3 miles from Steamboat Wharf at Fredericksburg)

Showing Condition in June 1883

To accompany Report of S. T. Abert, U.S.C.E.

for fiscal year ending June 30th 1883



Scale

100 0 1 2 3 4 5 6 7 8 9 1000 FEET

The soundings are expressed in feet and show the depth at Mean Low Water, the plane of reference

The 6 feet curve is represented thus ~~~~

,, *9* ,, ,, ,, ,, ,, ~~~~

,, *12* ,, ,, ,, ,, ,, ~~~~

COMMERCIAL STATISTICS.

The total trade of Fredericksburg for the year 1881 was $4,500,000.

The amount of freight carried by the following railroads and steamers to and from Fredericksburg, during the year 1881, was—

	Tons.
By the Potomac, Fredericksburg and Piedmont Railroad	44,016
Richmond, Fredericksburg and Potomac Railroad	11,700
Weems line of steamers	12,000
Total	67,716

No estimate has been made of the quantity of material, or the number of barges and sailing vessels engaged in transporting railroad ties, lumber, and grain.

J 7.

IMPROVEMENT OF TOTUSKY RIVER, VIRGINIA.

HISTORY OF OPERATIONS.

A survey and examination of Totusky River was ordered in the act approved June 23, 1874. The duty was assigned to me by the Chief of Engineers July 9, 1874; a report and estimate were submitted March 3, 1875, and are quoted in the Report of the Chief of Engineers for the year 1881.

During the previous year an examination was made of Booker's Bar, and the following estimates are submitted in lieu of those previously given:

BOOKER'S BAR.

2,400 linear feet of dike, at $4 per foot	$9,600	00
For a channel 60 feet wide and 8 feet deep at low water, 25,520 cubic yards of dredging, at 35 cents	8,932	00
	18,532	00
Contingencies, 15 per cent	2,779	80
	21,311	80

BAR AT MOUTH.

For channel 100 feet wide and 8 feet deep at low water, 30,890 cubic yards dredging, at 35 cents	$10,811	50
Contingencies, 15 per cent	1,621	73
	12,433	23
Total for the two bars	33,745	03

The act of June 14, 1880, appropriated $2,500 for the improvement of this river, and the work was assigned to me by the Chief of Engineers June 17, 1880.

It being apparent that the appropriation was too small to be expended economically, no project was submitted until after the further appropriation of $2,500, by act of March 3, 1881, gave promise of better results from the expenditure of the combined appropriations. An examination was then made, a project submitted for the construction of a dike at Booker's Bar, specifications were prepared, and the work offered for contract by public advertisement in the usual way, the proposals to be opened July 9, 1881. One bid only was received, and was regarded as too high for the economical execution of the work.

With approval of the Chief of Engineers, further operations were suspended until an additional appropriation might be made.

WORK DURING THE FISCAL YEAR ENDING JUNE 30, 1883.

The length of longitudinal dike is 2,117 feet. It is constructed of logs supported by piles. Its height is 4 feet above low-water; the length of each pile is 35 feet, except at the upper end, where the length is 32 feet.

The average cost per linear foot is $2.33. This includes the brush, which is laid along the front for a distance of 1,150 feet.

The effect intended to be produced by the dike could be promptly attained by dredging a parallel channel, 80 feet wide and 8 feet deep, which would cost about $10,000; but this dredging will be partly accomplished by the scour of the current.

The dike (2,117 linear feet in length) is constructed with the following amount and lengths of material, to wit:

	Linear feet
530 white-oak piles, 35 feet long each	18,550
20 white-oak fender-piles, 35 feet long each	700
427 white-oak logs, 23 feet long each	9,821
657 pine logs, 23 feet long each	15,111
	Pounds.
214 1¼-inch bolts, from 40 to 65 inches long each, less bolt heads and bolt ends excluded	2,613
73 pounds of spikes for mattresses	73
440 bolt heads and ends, 1¼-inch round iron	1,752
15 pounds wire for mattresses	15
440 3½-inch square by ¼-inch plate washers	343½
3,072 cubic feet of poles and brush for mattresses.	

STATEMENT OF TOTAL ITEMIZED COST IN BUILDING LONGITUDINAL DIKE AT BOOKER'S BAR, TOTUSKY RIVER, VIRGINIA; DATE, APRIL 28, 1883.

Inspector	$222 00	
Subinspector	160 25	
Blacksmith's bill	24 50	
Laborers' wages	462 07	
		$868 82
19,250 linear feet of oak piles, at 10 cents	1,925 00	
9,821 linear feet of white-oak logs, at 10 cents	982 10	
15,111 linear feet of pine logs, at 5½ cents	831 10	
		3,738 20
3,072 cubic feet of brush and poles for mattresses	30 00	
2,613 pounds of 1¼-inch round iron for bolts, at $3.50 per hundred	91 45	
1,752 pounds of 1¼-inch round iron bulkhead and ends, at $7 per hundred	122 64	
343½ pounds of 3½-inch square washers, at $3.50 per hundred	12 02	
73 pounds cut spikes for mattresses, at 4½ cents	3 18	
		259 29
Use of pile-driver and fuel	50 00	
Use of quarter-boat	30 00	
		80 00
Cost per linear foot of dike, $2.33		4,946 31

The following appropriations have been made:

June 14, 1880, $2,500.
March 3, 1881, $2,500.
August 2, 1882, $5,000.

The work is in the collection district of Tappahannock, which is the nearest port of entry. The nearest light-house is Bowler's Rock, in the fifth light-house district.

The collections for the year ending June 30, 1882, were $1,451.05

Money statement.

July 1, 1882, amount available	$4,945 81
Amount appropriated by act passed August 2, 1882	5,000 00
	9,945 81
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	8,242 65
July 1, 1883, amount available	1,703 16
Amount (estimated) required for completion of existing project	24,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	10,000 00

COMMERCIAL STATISTICS.

The following statistics of the river trade have been furnished by Mr. J. W. Phillips, of Warsaw, Richmond County:

Fertilizers	$10,000
Fish and oysters	25,000
Grain	30,000
Groceries	25,000
Hardware	10,000
Liquors	20,000
Railroad ties	40,000
Woven fabrics	20,000
Miscellaneous	19,000
Total	199,000

There is landed annually not less than $75,000 worth of general merchandise from the cities of Baltimore and Philadelphia in Totusky Creek. A large number of vessels come into this creek to buy wood and oysters, of which we have no account and cannot tell the number.

There are three landings on the creek, and a large business is done from each. Three-fourths of the county of Richmond and a large portion of Westmoreland are tributary to this creek. Thirty sailing vessels, twenty barges, and one hundred bateaux trade in the creek.

J 8.

IMPROVEMENT OF URBANA CREEK, VIRGINIA.

HISTORY OF OPERATIONS.

This creek is a tidal tributary of the Rappahannock. For vessels proceeding up stream it is the only harbor on the right side of the Rappahannock for a distance of 60 miles.

For a history of operations to June 30, 1882, see Report of Chief of Engineers for 1882, page 1029.

WORK DURING THE FISCAL YEAR 1882–'83.

August 2, 1882, $4,000 were appropriated. It was proposed to expend this sum in widening the channel through the bar outside of the creek, and in enlarging the basin below the wharf of Urbana. The estimated amount of excavation was 20,000 cubic yards.

It was also proposed to strengthen the narrow sand spit which separates the creek from the Rappahannock River, at a point on the spit where the high water occasionally makes a breach.

The bids received on September 20, being too high, the work was again offered, and the following table is an abstract of bids received December 21.

Abstract of proposals for improving Urbana Creek, Virginia, opened December 21, 1882.

[For 25,000 cubic yards dredging.]

No.	Names and addresses of bidders.	Price.	Amount.	Number and kind of machines used.	Daily amount of work expected.	Date of commencement.	Date of completion.
		Pr. cu. yd.			*Cubic yards.*		
*1	Daniel Constantine, Baltimore, Md.	$0 22	$5,500 00	One dipper-dredge.	500	.....	June 15, 1883.
		15	3,750 00				
†2	Potomac Dredging Company, Washington, D. C.	24⅝	6,222 22	.....do	300	Jan. 22, 1883.	June 15, 1883.
‡3	Isaac R. Bowen, Georgetown, D. C.	27½	6,875 00	....do	300 to 500	Soon as practicable.	June 15, 1883.
		30	7,500 00				
§4	George E. Ward, Alexandria, Va.	26	6,500 00	Two or more dipper-dredges.	300	Soon as practicable.	June 15, 1883.
5	Henry Birch, Washington, D. C.	27	6,750 00	One dredge ...	350 to 400	Jan. 22, 1883.	June 15, 1883.

*Daniel Constantine offers to do the work at Urbana Creek for 15 cents per cubic yard, provided he is awarded the contract for Rappahannock River, Virginia, proposals for which were opened on the same date.

† Potomac Dredging Company bid on condition that payment for work is made not later than the 10th of each month.

‡ Isaac R. Bowen will do work at Urbana for 27½ cents per cubic yard, if awarded contracts for Saint Jerome's Creek, Maryland, and Rappahannock River, Virginia, proposals opened the same date.

§ George E. Ward says his bid is contingent upon the award of the contracts for Saint Jerome's Creek, Maryland, and Rappahannock River, Virginia.

The contract was awarded to Mr. Daniel Constantine, the lowest bidder, at 15 cents per cubic yard.

At the close of the fiscal year 5,900 cubic yards had been removed from the bar at the mouth, and the work is still in progress.

A map of Urbana Creek accompanies this report.

Appropriations have been made as follows:

March 3, 1879	$5,000
June 14, 1880	2,500
March 3, 1881	4,000
August 2, 1882	4,000

For the completion of the work $5,000 will be needed according to the original estimate.

Since the improvement has been commenced at Urbana Creek several vessels of 500 and 600 tons, 12 feet draught of water, have landed in the creek, instead of lying outside as heretofore, exposed to the storms and causing great delay in lightering, thereby causing greater expense to the shippers. This has, in a measure, been obviated, yet the channel is not sufficiently wide to allow them to pass in and out without considerable difficulty. Steamers do not yet enter the creek. The captains claim the narrow passage renders the channel dangerous.

Urbana is a port of entry and is in the collection district of Tappahannock.

The collections for the year ending June 30, 1882, were $1,451.05.

Money statement.

July 1, 1882, amount available	$21 27
Amount appropriated by act passed August 2, 1882	4,000 00
	4,021 27
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	411 51
July 1, 1883, amount available	3,609 76
Amount (estimated) required for completion of existing project	5,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	5,000 00

COMMERCIAL STATISTICS.

The following statistics of trade have been furnished by Mr. A. Palmer, of Urbana, Middlesex County, Va., for the year ending December 30, 1882:

Bacon	$9,000
Beef and other cattle	2,000
Eggs	2,500
Fish and oysters	200,000
Fruits (green and dried)	5,000
Grain	10,000
Lumber (sawed)	15,000
Pease and beans	400
Railroad ties	10,000
Sheep and lambs	1,500
Tobacco	2,000
Wood	6,000
Wool	2,500
Ship timber	15,000
Canned goods	10,000
Miscellaneous (coal, furs, hides, potatoes, &c.)	5,000
Total	295,900

MANUFACTURES.

Agricultural implements	$1,000
Drugs and chemicals	1,500
Fertilizers	4,000
Flour	6,000
Furniture	2,000
Groceries	20,000
Hardware	5,000
Leather	1,000
Liquors	2,000
Dry goods, notions and merchandise, not included above	50,200
Total	92,700

This report embraces a country extending back 7 miles, with 2 miles front on the river.

J 9.

IMPROVEMENT OF MATTAPONI RIVER, VIRGINIA.

HISTORY OF OPERATIONS.

A full description of the part of the river which requires improvement, about 36 miles in length, and an account of the obstructions to navigation, are contained in the Report of the Chief of Engineers for the year 1880, and may be found in Part I, page 770.

The following table from the last Report presents a summary of the localities, nature of improvement, and estimate of cost:

Name of locality.	Distance from Munday's Bridge.	Description of work.	Excavation estimated at 40 cents per cubic yard.	Cost.
	Miles.		*Cubic yards.*	
Pocket Bend Cut-off	12	Closing channel		$1,000
Second Cut-off	15	do		500
Removing logs, trees, and drift as far as Aylett's	26	Removing snags, &c		7,800
Wreck at Aylett's	26	Removing wreck		250
Old Hall Bar	27	Dredging	6,666	2,667
Wreck below Aylett's	27½	Removing wreck		300
Walker's Bar	32	Dredging	7,407	2,963
Sale's Bar	32½	do	5,925	2,371
Presque Isle Bar	33	do	10,666	4,266
Between Presque Isle and Robinson's		Removing snags, &c		250
Robinson's Bar	35	Dredging	8,888	3,555
Pointer's or Latane's Bar	38	do	7,111	2,844
Line Tree Bar	38½	do	4,742	1,897
At other points		Snags, &c		300
				30,963
Add for contingencies 10 per cent				3,096
Total				34,059

The distances are only approximately correct.

Of this total $22,619 was intended for dredging, and $11,440 was to be applied to clearing the old channel of logs, snags, wrecks, &c.

The amount which has been expended on this work, less contingencies, is $5,800.

A history of the operations until the close of the fiscal year ending June 30, 1882, will be found in the Report of the Chief of Engineers for the year 1882.

WORK DURING THE PAST FISCAL YEAR, 1882–1883.

Snags removed	94
Drift logs	3
Overhanging trees	276

Five stumps and one wreck were removed, the boats were calked, and laid up at Aylett's July 25, 1882.

Since the close of operations to the ending of the present fiscal year, July 30, 1883, the boats have been laying near Aylett's, under the care of a watchman.

Appropriations have been made as follows:

June 14, 1880	$2,500 00
March 3, 1881	3,300 00

The work is in the collection district of Yorktown, which is the nearest port of entry. The nearest light-house is Bell Rock, in the fifth light-house district.

The collections for the year ending June 30, 1882, were $1,287.41.

Money statement.

July 1, 1882, amount available	$769 85
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities, July 1, 1882	769 85
Amount (estimated) required for completion of existing project	28,300 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	10,000 00

J 10.

IMPROVEMENT OF PAMUNKEY RIVER, VIRGINIA.

HISTORY OF OPERATIONS.

A description of the part of the river, about 30 miles in length, which requires improvement, with an account of the obstructions to navigation, may be found in the Report of the Chief of Engineers, 1880, Part I, page 773.

The localities requiring improvement, nature of improvement, and estimates of cost are summarized in the following table, taken from the above-mentioned report.

Approximate estimate.

[The distance in miles is reckoned from Hanovertown, and is estimated, not measured.]

Localities.	Distance in miles.	Cost of removing.		Dredging.		Total cost.
		Wrecks.	Logs, snags, &c.	Cubic yards.	Cost at 45 cents per cubic yard.	
Potomoy Creek	4	.....	.....	2,600	$1,170	$1,170
Dr. Wormley's Landing	5	.....	$1,000	.....	.....	1,000
Whale's Back Bar	5¾	.....	.....	2,700	1,215	1,215
New Castle Ferry	9	.....	800	.....	.....	800
Skidmore's Bar, or Upper Bassett	13	.....	400	2,700	1,215	1,615
Bassett's Ferry	14	.....	.....	.....	.....	.....
Bassett's Bar	14¼	$3,000	.....	2,800	1,260	4,260
Carter's Island	18	1,600	300	.....	.....	1,900
Spring Bar	19¾	.....	.....	3,400	1,530	1,530
Piping Tree	28	.....	300	.....	.....	300
Garlic's Bar	31	800	.....	.....	.....	800
Mouth of river	80	.....	.....	.....	.....	.....
Aggregate	.....	5,400	2,800	14,200	6,390	14,590
Add 20 per cent. for contingencies	.....	.....	.....	.....	.....	2,918
Total estimate	.....	.....	.....	.....	.....	17,508

The cost of removing wrecks, logs, snags, &c., $8,200.

A history of operations until the close of the fiscal year ending June 30, 1882, will be found in the report of the Chief of Engineers for the year 1882.

The following appropriations have been made:

June 14, 1880	$2,500
March 3, 1881	2,500
August 2, 1882	2,500

The appropriation of August 2 was regarded as too small for economical dredging. No work has been done during the present fiscal year.

The greater part of the amount required for 1885 will be expended by contract in dredging.

The work is in the collection district of Yorktown, which is the nearest port of entry. The nearest light-house is Bell Rock, in the fifth light-house district.

The collections for the year ending June 30, 1882, were $1,287.41.

Money statement.

July 1, 1882, amount available	$166 72
Amount appropriated by act passed August 2, 1882	2,500 00
	2,666 72
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	166 72
July 1, 1883, amount available	2,500 00
Amount (estimated) required for completion of existing project	10,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	10,000 00

J 11.

IMPROVEMENT OF YORK RIVER, VIRGINIA.

HISTORY OF OPERATIONS.

A report of the survey of the bars forming the obstructions to the navigation of this river will be found in the Report of the Chief of Engineers for the year ending June 30, 1880, Appendix I 18, page 897.

The project for the improvement is the excavation of channels 22 feet deep and 200 feet wide through the bars at West Point and Potopotank, with an increased width at the wharves at West Point.

The first appropriation for this improvement was made in the river and harbor act of June 14, 1880, the amount being $10,000.

This amount being insufficient to effect a satisfactory improvement through the bars at West Point, the recommendation that it be applied to the improvement of the bar at Potopotank Creek was approved.

The award of work was made to the National Dredging Company at 15 cents per cubic yard, and the contract was entered into October 6, 1880, the work to be begun on or before the 1st of March, 1881, and completed on or before June 30, 1881.

The contract was completed on the 31st of March, 1881, 58,809 cubic yards having been taken out, at a cost of 15 cents per cubic yard.

The result of the work was a channel through Potopotank Bar, 105 feet wide and 22 feet deep at low water, which is all the improvement that will be required at this locality at present.

The act of March 3, 1881, appropriated $25,000 for the improvement of York River.

Proposals for dredging were invited by public advertisement.

The bids were found to be too high, and the work was again advertised.

The contract was awarded to the National Dredging Company, and articles of agreement were entered into September 3, 1881.

Dredging under this contract was commenced at the West Point Channel on October 4, 1881. The work was executed promptly, and the first cut through the bar, 40 feet wide, completed November 10, 1881

The material found was soft mud. The second cut, about 30 feet wide, was carried to within about 500 feet of the lower end of the bar, when funds available for the dredging were exhausted. Except at this locality, the dredged channel is 70 feet wide and 19 feet deep at extreme low water; 137,989 cubic yards of material were removed.

The channel at West Point should be still farther widened to 200 feet

to meet the requirements of the increasing foreign and domestic trade at this important shipping point.

FISCAL YEAR ENDING JUNE 30, 1883.

The work was offered for contract September 20, 1882.
The following table exhibits an abstract of the bids received:

Abstract of proposals for improving York River, Virginia, opened September 20, 1882.

[For 140,000 cubic yards of dredging.]

No.	Names and addresses of bidders.	Deposited three-fifths of a mile from place of dredging.		Deposited 4 miles from place of dredging.		Number and kinds of machinery used.	Daily amount of work expected, cubic yards.	Date of commencement.	Date of completion.
		Price per cubic yard.	Amount.	Price per cubic yard.	Amount.				
								1882.	
1	Delaware and Chesapeake Improvement Company, Philadelphia, Pa.	$0 13	$18,200	$0 13½	$18,900	One clam-shell machine.	3,000	Dec. 15	In two or three months.
								1883.	1883.
2	American Dredging Company, Philadelphia, Pa.	13	18,200	15	21,000	All necessary machinery.	.....	Mar. 1	June 15
3	National Dredging Company, Washington, D. C.	15	21,000	16	22,400	Requisite machinery.	.....	Jan. 15	June 15
								1882.	
4	Jas. Caler & Son, Baltimore, Md.	17	23,800	17¾	24,800	....	.....	Oct. 10	June 15
5	Potomac Dredging Company, Washington, D. C.	15	21,000	18½	25,900	One clam-shell dredge.	1,200	Nov. 1	June 15
6	Henry Birch, Washington, D. C.	22	30,800	25	35,000	One dredge.....	500	Nov. 1	June 15

The contract was awarded to the Delaware and Chesapeake Improvement Company at 13 and 13½ cents per cubic yard, according to distance of the specified dumping grounds. Dredging was commenced upon the bar just below West Point, on December 8, 1882, and was completed March 24, 1883. The work consisted in widening the channel dredged last year, which was left 75 feet wide and about 19 feet deep at extreme low water, or 21 feet at mean, for the length of 11,000 feet.

The completed channel is now 120 feet wide from the upper end of the bar to opposite the black buoy, a distance of 7,800 feet; and 146 feet wide from this point to 500 feet below the red buoy at the angle in the channel, which is 1,700 feet further on; thence 100 feet wide to the lower end of the bar; a total distance of 11,100 feet. The depth of the channel dredged this year is about 22 feet at mean low water; that of last year is 21 feet.

The gross amount of material removed under the present contract is 135,606 cubic yards, and 4,892 cubic yards have been deducted on account of excess of depth, which leaves a net excavation of 130,714 cubic yards, for which the Delaware and Chesapeake Company have been paid.

The amount excavated under the former contract was 137,989 cubic yards, which gives a total of 268,703 cubic yards removed from the channel.

The material has been dumped near Goff's Point, between Stations 1 and 17, and at an average distance of three-quarters of a mile from the bar. The dumping ground is now well filled, between the 9 and 6 foot curves, and lighter draught scows must be used in the future, or some other place must be selected.

A locality below Terrapin Point will offer good deep-water dumping ground, provided the under current is not too swift, and no objection will probably be made by oystermen and fishermen.

Light-draught dumping scows can be used in water varying from 3 to 6 feet deep, at low tide, near Goff's Point, or at the same depth on the right of the channel.

The average daily work done by the contractors during working days has been 1,329 cubic yards, at a cost of $90 per day, deduced from the following items:

Hire of tugs with crew	$40
Board of men	8
Coal	10
Wages of superintendent and crew	32
Total	90

To this must be added the interest upon the cost of plant, the wear and tear of machinery, and the cost of transportation. The contractors value the dredge at $50,000 and the scows at $16,000, or $4,000 for each scow.

Two ranges were left on Terrapin Point to align the channel. They mark the west side of the cut from the upper end to the black buoy.

Permanent cedar stakes were also set on Terrapin Point to mark the continuation of the center line of the proposed channel. These are shown on the map.

STATISTICS OF TRADE.

Shipments, it is said, have doubled in the last eighteen months.

Nearly all the freight of the Richmond, Danville, and Piedmont Air Line Railroads are now shipped at West Point. Trade has been increased by the cotton-compress built last year. Seven trans-Atlantic steamers and one bark have received loads since December. The largest of these was registered to carry 3,000 tons; its draught was 22 feet. The draught of the others varied from 18 to 20 feet. They were loaded principally with cotton for Europe and flour for South America.

Appropriations have been made as follows:

June 14, 1880	$10,000
March 3, 1881	25,000
August 2, 1882	25,000

The amount required for the completion of the improvement, according to original estimate June 30, 1885, is $43,000, and I respectfully recommend that $50,000 be appropriated for the year ending June 30, 1885, on account of the increased contingent expenses.

A map of York River at West Point, showing the condition of the work at the close of the fiscal year ending June 30, 1883, accompanies this report.

York River is in the collection district of Yorktown, which is the nearest port of entry. The nearest light-house is Bell Rock, in the fifth light-house district.

The collections for the year ending June 30, 1882, were $1,287.

Money statement.

July 1, 1882, amount available	$99 59
Amount appropriated by act passed August 2, 1882	25,000 00
	25,099 59
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	20,306 46
July 1, 1883, amount available	4,793 13
Amount (estimated) required for completion of existing project	50,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	50,000 00

J 12.

IMPROVEMENT OF CHICKAHOMINY RIVER, VIRGINIA.

HISTORY OF OPERATIONS.

The obstruction to navigation above the mouth consisted of three bars—Binn's, Old Fort, and Windsor Shades—from 23 to 25 miles from the mouth of the river, over which but 4 to 5 feet could be carried at low water.

The bar at the mouth of the river, until November 11, 1882, when dredging was commenced, formed the principal obstruction to navigation. A survey of this bar, made in June, 1882, found the depth at low water to be 12.3 feet.

The channel was very narrow and tortuous, and vessels frequently grounded in entering and leaving the river.

The plan of improvement contemplated dredging a channel 200 feet wide and 14 to 15 feet deep at low water through the bar. The material is hard clay, sand, and some gravel, and allowance for this was made in the estimate.

I estimated the cost of the work as follows:

38,167 cubic yards dredging, at 40 cents	$15,266 80
Contingencies, 15 per cent	2,290 00
Total	17,556 80
Deduct appropriation August 2, 1882	5,000 00
Due on original estimate	12,556 80

FISCAL YEAR ENDING JUNE 30, 1883.

Proposals were opened for dredging the bars in the mouth of the river September 20, 1882. The following is an abstract of bids received:

Abstract of proposals for improving Chickahominy River, Virginia, opened September 20, 1882

[For 36,000 cubic yards dredging.]

No.	Names and addresses of bidders.	Price.	Amount.	Number and kind of machines used.	Daily amount of work expected.	Date of commencement.	Date of completion.
		Per cu. yd.			*Cubic yards.*		
1	Henry Birch, Washington, D. C.	$0 50	$18,000	One dipper-dredge.	300	Oct. 20, 1882	June 15, 1883
2	Potomac Dredging Company, Washington, D. C.	49	17,640	One dipper-dredge.	200	Oct. 20, 1882	June 15, 1883
3	H. E. Culpepper, Portsmouth, Va.	32½	11,700	One or more dredges.	300	Feb. 15, 1883	June 15, 1883
4	James Caler & Son, Baltimore, Md.	22½	8,100	One dipper-dredge.	.....	Nov. 1, 1882	June 15, 1883

The contract was awarded to James Caler & Son, Norfolk, Va., the lowest bidders, at 22½ cents per cubic yard. The bar is situated about 49 miles above Norfolk, Va.

The work commenced November 11, 1882, and was completed March 29, 1883; 19,859 cubic yards were dredged, giving a channel 90 feet wide and 14 feet deep at low water, and 1,800 feet long.

In order to make a channel sufficiently wide for vessels beating in and out of the river, double this amount should be excavated.

The largest daily average amount dredged during any one week was 325 cubic yards.

There were many suspensions of work, caused by the breaking of the machinery.

The material was hard clay, sand, and some gravel, and the tow-boat was furnished with a large force pump for the purpose of forcing the material out of the scows by water pressure.

The dredged material was deposited about 1 mile from the dredged channel upon the flats, in water which was 6 feet deep at low tide.

A map showing the condition of the bar at the mouth of the Chickahominy River, at the close of the fiscal year ending June 30, 1883, accompanies this report.

Appropriations have been made as follows:

For the river between Binn's Bar and Windsor Shades:

June 13, 1878	$5,000
March 3, 1879	1,000
June 14, 1880	2,000
March 3, 1881	2,000

For the bar at the mouth:

August 2, 1882	$5,000

The work is in the collection district of Richmond, which is the nearest port of entry. The nearest light-house, is Deep-Water Shoal light-house in the fifth light-house district.

The collections for the year ending June 30, 1882, were $23,009.69.

Money statement.

July 1, 1882, amount available	$1,758	37
Amount appropriated by act passed August 2, 1882	5,000	00
	6,758	37
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	6,207	20
July 1, 1883, amount available	551	17
Amount (estimated) required for completion of existing project	13,000	00
Amount that can be profitably expended in fiscal year ending June 30, 1885	13,000	00

J 13.

IMPROVEMENT OF STAUNTON RIVER, VIRGINIA.

HISTORY OF THE IMPROVEMENT.

An examination of the river between Brookneal and Roanoke Station was made in 1878, and my report will be found in the Report of the Chief of Engineers for 1879, Part I, page 622.

The estimated cost of the work is $68,700.

The project for the improvement is to provide a channel through the bars and ledges not less than 35 feet wide and 2 feet deep at low water.

For a history of operations, see Report of the Chief of Engineers for the year 1882.

WORK DONE IN THE FISCAL YEAR BETWEEN JUNE 30, 1882, AND JUNE 30, 1883.

The appropriation became available so late in the season that high water soon put a stop to operations.

The derrick-boat was repaired and the flats calked.

Three hundred and seven cubic yards of rock were removed at an average cost of $\$2.50\frac{3}{7}$ per yard, seven snags at $1.37, and thirty-five trees at $0.87 each.

A condensed statement of the work done is as follows:

Removing boats, tools, and supplies	$52 86
Repairing boats, constructing derrick	72 20
Covering quarter boat, labor, and material	49 33
Mooring boats, storing property	25 00
7 snags, $1.37 each	9 59
35 trees, $0.87 each	30 45
307 cubic yards excavated $\$2.50\frac{3}{7}$	768 87
592 feet holes drilled at 20 cents per foot	118 40

The channel was improved for the distance of 4 miles by the excavation of rock, and for the distance of 3 miles by the construction of spur dikes. This statement is the result of the work since its commencement.

Operations were stopped by high water October 31, 1882, and work was not resumed before the close of the fiscal year ending June 30, 1883.

The amount needed to complete the improvement (June 30, 1883) is $46,200, and I would respectfully recommend an appropriation of $15,000 for the year ending June 30, 1885, if the work is to be continued.

The following appropriations have been made:

March 3, 1879	$5,000
June 14, 1880	7,500
March 3, 1881	5,000
August 2, 1882	5,000

Three maps of the Staunton River accompany this report, viz:

1. A general map showing the work proposed between Brookneal and Roanoke Station.
2. A profile of the same.
3. A map showing the work completed in 1881 and 1882. The work of blasting only is shown.

Money statement.

July 1, 1882, amount available	$237 97	
Amount appropriated by act passed August 2, 1882	5,000 00	
		5,237 97
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		1,489 20
July 1, 1883, amount available		3,748 77
Amount (estimated) required for completion of existing project		46,200 00
Amount that can be profitably expended in fiscal year ending June 20, 1885.		15,000 00

UPPER STAUNTON RIVER.

The act of appropriation for rivers and harbors approved March 3, 1881, provided for an examination of the Staunton River, Virginia, between Pig River and Brookneal. This duty having been assigned to me, a reconnaissance of the river was made and a report upon the same, with estimates for the improvement, was submitted February 16, 1882.

The plan of improvement proposed is to secure a channel 20 feet wide and 2 feet deep at low water for bateau navigation, by blasting rock and dredging through gravel bars, and also by contracting the stream by means of spur dams; the width between the dams being not less than 35 feet.

The estimate for the improvement is $41,000. This estimate was, however, based upon a reconnaissance, which will need to be supplemented by detailed surveys as the work proceeds.

The Roanoke Navigation Company, up to within a few years, ran bateaux over this portion of the river. Some of their towing walls and sluices still remain, but are out of repair. Bateaux would probably serve the purpose of transportation for five or six months in the year if the channel is improved for low-water navigation.

The fall of the river is so great that the cost of improving it for steam navigation would not be justified by the small amount of produce which at the present time is likely to find its way to market.

The works of the Roanake Navigation Company are now so much out of repair that at low water a canoe can with difficulty make its way. As the water rises, however, navigation becomes practicable with bateaux. The freshets rise to a height of from 20 to 30 feet. In some of the rapids the water has a velocity of from 5 to 7 miles an hour.

PLAN OF IMPROVEMENT.

The only method which seems practicable is that which would facilitate bateau navigation.

Through the rocky rapids a sufficient depth can be gained by blasting and also by contracting the stream by means of spur-dams, which should project from opposite sides of the river, leaving a gap for the water-way of not less than 35 feet. It is intended that these dams should swell the water about 3 inches, and it will therefore be necessary to determine by investigation the exact width of the water-way.

The crib-dams are assumed to have an average height of 2½ feet, with a width of 5 feet; they are estimated at the cost of $2.50 per linear foot. The excavation will have an average width of 20 feet and a depth of two feet at low water, and is estimated at $3 per cubic yard. The dredging, which will be generally of gravel, is estimated at 75 cents per cubic yard, and will be removed to the convex side of the river. For those points which could not be estimated in the rapid inspection given it would be safe to add 20 per cent. of the cost of the entire work. (See Report of Chief of Engineers for 1882, page 1047.)

WORK OF THE FISCAL YEAR BETWEEN JUNE 30, 1882, AND JUNE 30, 1883.

A project was submitted August 2, 1882, for expending the appropriation above Brookneal, in order that this work might be under the supervision of the inspector in charge of the work below Brookneal. In a letter signed by John H. Hurt and others, referred to me by the

Bureau, September 19, it was suggested that the work be commenced at Clement's Falls, above the bridge of the Lynchburg and Danville Railroad. A more careful survey was therefore made of that part of the Staunton between Pig River and the railroad bridge. In the following report I have given all the important facts obtained and have added an estimate for improving this part of the river.

SURVEY OF THE UPPER STAUNTON RIVER, VIRGINIA, OR THAT PORTION OF THE RIVER LYING BETWEEN THE VIRGINIA MIDLAND RAILROAD BRIDGE AND PIG RIVER, A DISTANCE OF 23½ MILES.

The survey was commenced in October, 1882, and was completed in November.

It is proposed to improve the river for bateau navigation, and two estimates have been made.

First estimate for a channel 2 feet deep and 14 feet wide, including contingencies, will be $33,829.

Second estimate for a channel 1½ feet deep and 14 feet wide, including contingencies, will be $15,710.

NOTES ON THE SHOALS.

Between Pig River and Smith's Shoal a small quantity of rock will have to be removed.

Smith's Shoal.—Rock and gravel excavation will be necessary.

Towler's Shoal consists of fish-trap dam and ledge of rocks.

Johnson's Shoal (which comprises Falls Nos. 1, 2, 3) is continuous for about 4,300 feet; the descent in the river at the falls is very abrupt, but when the excavation is made it will come within the limits of 10 feet to the mile; the excavation will be nearly all solid rock, with some gravel which is found on top, and some old fish-trap dams on shoal places will have to be removed.

Parker's Falls, formed by ledges of rock, small amount of excavation necessary.

Leftwick's Shoals (1 and 2), loose rock will be found; Shoal No. 1, some solid rock. This shoal (No. 2) consists chiefly of ledges of rock. The next shoal encountered is Cow Ford, 5½ miles below Pig River; here the fall is quite heavy and considerable work will be necessary in excavating the ledges of rock, which extend across the river.

Anthony's Shoal, Nos. 1 and 2, consisting of rock and gravel excavation; fall not very great.

Brown's Shoal.—The excavation will consist chiefly of rock.

Tuck's Shoal and Falls.—The fall is swift; the shoal is composed of loose rock and gravel.

Three Island Ford Shoal.—At the upper end of this shoal near the ford, is some gravel, but the most of the shoal is composed of rock.

Ward's Shoal is the next, which is about 9 miles below Pig River. The fall is uniform and gives very little trouble; the excavation is rock and gravel.

Chelish's Shoal and Fish-trap.—The shoal is made of rock and gravel; an old fish-trap should be removed.

Tardy's Fish-trap.—The fall here is rather abrupt, caused by an old fish-trap dam and short shoal of rock.

Mattox's Shoal and Fish-trap.—The fall here is nearly perpendicular, but can be overcome by removing the fish-trap dam, which is composed of loose rock; some solid rock will also have to be excavated.

Lee's Island Shoal.—The best channel for bateaux here is on the right side, which is between Lee's Island and right bank of river; the island is about 800 feet long and from 400 to 500 feet wide in the widest places; the flow is quite swift. The excavation is chiefly solid rock, with some loose rock and gravel.

Taylor's Ford Shoal No. 1.—The excavation consists of rock and gravel; there is a very good ford at this point; the fall is not very heavy.

Taylor's Ford Shoal No. 2.—The fall is quite heavy here; the excavation is nearly all rock.

Anderson's Shoals Nos. 1 *and* 2.—Fall at these shoals is swift for a short distance; excavation rock and gravel.

Smith's Shoals Nos. 1 *and* 2.—Smith's Shoal No. 1, the current is swift for a short distance; Shoal No 2, the fall is moderate.

Vaughn's Fish Trap.—The excavation here will be principally loose rock from the fish-trap dam, and some gravel to be removed.

Haley's Shoal.—Fall moderate; excavation solid and loose rock; some of the loose rock has been placed in the river with the intention of improving the boat sluice.

Pocket Shoal No. 1.—The fall is heavy here; the best channel is found near the center of the river; several large rocks near left bank; the excavation is rock and gravel. Pocket Ford Island is near the right bank, near ford.

Pocket Shoal No. 2.—Excavation loose rock and gravel; an old dam built of rock on a gravel shoal was found for improving the boat sluice; fall slight.

Pocket Shoal No. 3.—Excavation rock and gravel; heavy fall for a short distance.

Clement's Falls.—The fall is very heavy and is one of the most troublesome places on the river for boats to pass; it is about three-fourths of a mile above the Virginia Midland Railroad Bridge; the excavation is chiefly rock.

For the above notes I am indebted to the survey made by Mr. Howard Johnson, assistant engineer.

A general map of the Staunton between Pig River and the bridge of the Virginia Midland Railroad, accompanies this report; also, a profile showing the work proposed at Clement's Falls.

ESTIMATES FOR IMPROVING STAUNTON RIVER, VIRGINIA, FROM PIG RIVER TO THE CROSSING OF THE VIRGINIA MIDLAND RAILROAD BRIDGE FOR BATEAU NAVIGATION. DISTANCE 23½ MILES.

First. Estimate for a channel 2 feet deep, with a width of 14 feet.
Second. Estimate for a channel 1½ feet deep and 14 feet wide.

Distance from Pig River.	Locality to be improved.	Fall in given distance.	Total per mile.	Total fall from Pig River.	Channel 2 by 14 feet.		Channel 1½ by 14 feet.	
					Rock excavation.	Cost of excavation, at $3 per cubic yard.	Rock excavation.	Cost of excavation, at $3 per cubic yard.
Miles.		*Feet.*	*Feet.*	*Feet.*	*Cub. yds*		*Cub. yds*	
.....	Pig River	.....	.....	.....	20	$60 00	.....	.....
¼	Smith's Shoal	.....	.....	.....	113	339 00	14	$42 00
¾	Towler's Ferry Shoal	.....	.....	1.660	262	786 00	55	165 00
1	Towler's Falls*	.....	.....	2.115	103	309 00	36	108 00
1¾	Johnson's Falls No. 1	.558	.....	.....	.....	.....	.....	.....
.....	Johnson's Falls No. 2	.990	.....	.....	.....	.....	.....	.....

* These falls are nearly vertical.

Estimates for improving Staunton River, Virginia, &c.—Continued.

Distance from Pig River.	Locality to be improved.	Fall in given distance.	Total per mile.	Total fall from Pig River.	Channel 2 by 14 feet.		Channel 1½ by 14 feet.	
					Rock excavation.	Cost of excavation, at $3 per cubic yard.	Rock excavation.	Cost of excavation, at $3 per cubic yard.
Miles.		*Feet.*	*Feet.*	*Feet.*	*Cub.yds*		*Cub.yds*	
.....	Johnson's Falls No. 3	.703	.....	.....	.....	.....	.....	.....
2½	Johnson's Shoal (including falls).*	2.427 in 780	16.428	10.466	1,319	3,957 00	686	2,058 00
3⅓	Parker's Falls	.891 in 300	15.68	12.089	53	159 00	30	90 00
4⅛	Leftwick's Shoal No. 1	.....	.....	.....	124	372 00	41	123 00
4¾	Leftwick's Shoal No. 2	.....	.....	15.176	98	294 00	14	42 00
5⅓	Cow Ford Shoal	1.878 in 600	16.52	20.171	859	2,577 00	510	1,530 00
6⅓	Anthony's Shoal No. 1	.....	.....	.....	213	639 00	62	186 00
7	Anthony's Shoal No. 2	.567 in 400	7.484	23.616	280	840 00	72	216 00
7¾	Brown's Shoal	.884 in 350	13.335	25.319	287	861 00	118	354 00
8	Tuck's Shoal	1.941 in 400	25.621	27.706	680	2,040 00	290	870 00
8⅓	Tuck's Falls	.606 in 200	15.540	29.426	.....	.....	.....	.....
8¾	Three Island Shoal	.410 in 300	7.216	31.780	443	1,329 00	117	351 00
9	Ward's Shoal	.....	.....	33.180	203	609 00	23	69 00
.....	Chelish's Shoal	1.283 in 600	11.290	.....	.....	.....	.....	.....
10⅓	Chelish's Fish-trap	1.442 in 350	21.45	38.992	783	2,349 00	449	1,347 00
10½	Tardy's Fish-trap	.712 in 200	18.79	39.840	170	510 00	77	231 00
10¾	Mattox Shoal and Fish-trap	2.397 in 300	42.1	42.923	777	2,331 00	492	1,476 00
12½	Lee's Island Shoal	.320 in 1,650	10.23	47.625	242	726 00	59	177 00
.....	Taylor's Ford Shoal No. 1	.....	.....	.....	290	870 00	166	498 00
13¾	Taylor's Ford Shoal No. 2	1.297 in 600	11.25	53.939	217	651 00	135	405 00
.....	Anderson's Shoal No. 1	.769 in 350	11.60	.....	259	777 00	103	309 00
14½	Anderson's Shoal No. 2	1.331 in 500	14.05	57.122	198	594 00	90	270 00
...	Smith's Shoal No. 1	.512 in 200	13.51	.....	18	54 00	7	21 00
15¾	Smith's Shoal No. 2	.437 in 250	9.22	60.471	60	180 00	36	108 00
17½	Vaughn's Fish-trap	.135 in 150	4.75	64.080	77	231 00	43	129 00
20	Haley's Shoal	1.045 in 600	9.19	68.220	51	153 00	18	54 00
20½	Pocket Shoal No. 1	1.653 in 500	17.45	.....	256	768 00	127	381 00
.....	Pocket Shoal No. 2	.....	.....	.....	109	327 00	34	102 00
20¾	Pocket Shoal No. 3	1.07 in 400	14.24	72.313	175	525 00	56	168 00
22¾	Clement's Falls	2.08 in 500	22.00	77.790	700	2,100 00	404	1,212 00
23½	Virginia Midland Railroad Bridge.	.....	.....	79.446	.....	.....	.....	.....
						28,317 00	.....	13,092 00
	Contingencies, 20 per cent.	.....	.....	.....	.....	5,663 40	.....	2,618 40
						33,980 40	.....	15,710 40

*Short, 1,300 feet long.

A profile of the part of the river covered by the above estimate was made, showing the amount of excavation required. Maps of each of the shoals were also made. It was thought advisable to recommend the expenditure of the appropriation of $2,000 at Clement's Falls in accordance with the request submitted to the Bureau by residents living below the falls.

The project submitted August 2, 1882, under which no work has yet been done, is therefore modified, so far as it relates to the part of the river to be improved. The appropriation of 1882 will be expended at Clement's Falls.

Money statement.

Amount appropriated by act passed August 2, 1882	$2,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	508 94
July 1, 1883, amount available	1,491 06
Amount (estimated) required for completion of existing project	38,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	10,000 00

J 14.

IMPROVEMENT OF DAN RIVER, VIRGINIA AND NORTH CAROLINA.

HISTORY OF THE IMPROVEMENT.

A survey of the portion of Dan River between Danbury, N. C., and Danville, Va., a distance of about 77½ miles, was made in 1879, and the report, with estimates for its improvement for bateau navigation and also for steam navigation by means of locks and dams, will be found in Appendix G 19, Report of Chief of Engineers for 1879; and in Appendix H 15, page 788, of the Report of 1880, a modification will be found of the estimate of steam navigation, based upon a depth of 3 feet of water, for six months of the year. The amount of the estimate is $52,000.

The original project for the work was in accordance with the estimate above referred to, and contemplated a channel 35 feet wide through ledges, with a depth of excavation of 1½ feet in poois, and 2 feet in rapids, and a maximum slope on rapids of 10 feet to the mile. (See Report of Chief of Engineers, Part I, page 788, 1880.)

The channel now being excavated is 16 feet wide.

For a history of operations up to July 5, 1882, see Report of the Chief of Engineers for the year 1882.

FISCAL YEAR ENDING JUNE 30, 1883.

A small amount of work was done below Bull Sluice, as far as Station 70, which completes the channel with a width of 16 and a depth of 2 feet, for a distance of nearly 4 miles from Danville.

Work was suspended October 28, 1882.

About 1,055 cubic yards of rock were quarried, which will be used in building spur-dams proposed for overcoming the descent of Bull Sluice.

The boats were moored at the right bank of the river in charge of a competent watchman.

The work was resumed June 13, 1883, and at the close of the fiscal year 4 miles and 692 feet were completed.

Appropriations have been made as follows:

June 14, 1880	$10,000
March 3, 1881	8,000
August 2, 1882	7,500

I would respectfully recommend that an appropriation of $15,000 be made for the year ending June 30, 1885, if Congress desires this work to be continued.

Money statement.

July 1, 1882, amount available		$786 05
Amount appropriated by act passed August 2, 1882		7,500 00
		8,286 05
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		4,030 28
July 1, 1883, amount available		4,255 77
Amount (estimated) required for completion of existing project	26,500 00	
Amount that can be profitably expended in fiscal year ending June 30, 1885	15,000 00	

J 15.

IMPROVEMENT OF ROANOKE RIVER, NORTH CAROLINA.

HISTORY OF OPERATIONS.

In Appendix G 14, Report of Chief of Engineers for 1879, may be found a summary of operations previous to that time, to which I respectfully refer.

In 1874 the work was transferred to my charge. Under an appropriation of $5,000, made in the act approved June 23, 1874, dikes were commenced at Indian Highland, which were successful in removing the bar at this point. This work appears to have been sufficient to meet the wants of the trade up to a recent date.

By reason of a land-slide which occurred at McRae's Landing, the piles of the retaining dike were forced out of position.

Repair of this dike was recommended in the Report of 1882, and $5,000 was appropriated for this object August 2, 1882.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1883.

The work was begun by building a dike to prevent the land-slide at McRae's Landing, on the 28th of May, and completed on the 20th of June. The old dike was repaired at the same time.

The pile-driver hired in Norfolk was safely returned.

Appropriations have been made as follows:

March 3, 1871	$20,000
June 10, 1872	10,000
March 3, 1873	10,000
June 23, 1874	5,000

These sums were expended.

The work upon the river ceased until the summer of 1882, when the repair of the dike at McRae's Landing was completed with the appropriation made August 2, 1882, $5,000.

Money statement.

Amount appropriated by act passed August 2, 1882	$5,000	00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1,1882	1,274	81
July 1, 1883, amount available	3,725	19
Amount (estimated) required for completion of existing project	10,000	00
Amount that can be profitably expended in fiscal year ending June 30, 1885	10,000	00

COMMERCIAL STATISTICS.

The freight of heavy-draught steamboats was increased during the past few years, and a large amount of produce and merchandise is shipped to and from different landings between Plymouth and Spring Gut Bar, the head of heavy draught steamboat navigation. The Roanoke, Norfolk and Baltimore Steamboat Company is running a new iron freight steamer, of 379 tons burden, and is building another of the same capacity.

At the present time 8 steamers make regular trips upon the river.

J 16.

IMPROVEMENT OF FRENCH BROAD RIVER, NORTH CAROLINA.

HISTORY OF THE IMPROVEMENT.

The river and harbor act of August 14, 1876, contained the first appropriation for improving French Broad River.

The estimated cost of improving the 32 miles of river from Brevard to Big Buck Shoal, so as to secure a channel 2½ feet deep at low water and 35 feet wide, is $45,500.

For a history of operations up to August 8, 1881, see Report of the Chief of Engineers for the year 1882.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1883.

August 2, 1882, $5,000, "continuing improvement from Smith's Bridge up."

This part of the river was not included in the report of February 12, 1878, and was consequently not covered by the estimate then submitted, amounting to $45,500. A survey was therefore made from Smith's Bridge to the foot of Long Shoal, a distance of 12⅛ miles, leaving about 4 miles, between the foot of Long Shoal and the termination of the former project of improvement at Big Buck Shoal, to be examined at some future day.

The following estimate is based upon this survey:

Estimates for improving French Broad River, North Carolina, from Smith's Bridge to foot of Long Shoals.

Locality.	Distance above Smith's Bridge.	Length of shoals.		Maximum slope of improved water surface per mile.	Kind of material to be removed.	Cost per cubic yard.	Number of cubic yards.	For a channel 2½ feet deep and 35 feet wide.		For a channel 2½ feet deep and 30 feet wide.	
								Amount.	Total.	Amount.	Total.
	Miles.	*Miles.*	*Feet.*	*Feet.*							
First shoal above Smith's Bridge	¼	.....	1,227	8.13	Rock	$3.50	266	$931		$797	
					Rock and gravel	1.75	254	444		380	
					Gravel and sand	1.00	174	174		150	
									$1,549 00		$1,327 00
Robert's Fish Trap	¾	.....	1,380	10.08	Rock	3.50	400	1,400		1,200	
					Rock and gravel	1.75	96	168		144	
									1,568 00		1,344 00
Third shoal above Smith's Bridge	1⅛	.....	500	5.65	Rock and gravel	1.75	44	77	77 00	66	66 00
Fourth shoal above Smith's Bridge	1½	.....	500	6.28	Rock and gravel	1.75	98	172	172 00	147	147 00
Fifth shoal above Smith's Bridge	1⅞	.....	435	3.75	Rock and gravel	1.75	64	112	112 00	96	96 00
Patton's Fish Trap	2¼	.....	500	9.03	Rock and gravel	1.75	151	264	264 00	227	227 00
Seventh shoal above Smith's Bridge	2⅝	.....	1,112	8.13	Rock and gravel	1.75	108	189		162	
					Gravel and sand	1.00	85	85		73	
									274 00		235 00
Tennant's Fish Trap	3	.....	400	5.28	Rock and gravel	1.75	94	165	165 00	142	142 00
Ninth shoal above Smith's Bridge	3¼	.....	1,400	6.92	Rock	3.30	100	350		300	
					Rock and gravel	1.75	33	58		50	
					Gravel and sand	1.00	170	170		146	
									578 00		496 00
Bell's Shoal	5⅜	.....	3,788	7.81	Rock	3.50	700	2,450		2,100	
		.....	.....	.....	Rock and gravel	1.75	763	1,335		1,144	
		.....	.....	.....	Gravel and sand	1.00	2	2		1	
									3,787 00		3,245 00
Patton's Bridge Shoal	6⅜	1	602	10.45	Rock	3.50	2,135	7,535		6,458	
		.....	.....	.....	Rock and gravel	1.75	1,445	2,529		2,168	
		.....	.....	.....	Gravel and sand	1.00	70	70		60	
									10,134 00		8,686 00
Taylor's Ford Shoal	7⅝	1	1,072	10.08	Rock	3.50	571	1,999		1,714	
		.....	.....	.....	Rock and gravel	1.75	747	1,307		1,120	
		.....	.....	.....	Gravel and sand	1.00	106	106		91	
									3,412 00		2,925 00
Sandy Bottom Shoal	11⅝	3	2,725	9.50	Rock	3.50	8,743	30,600		26,229	
		.....	.....	.....	Rock and gravel	1.75	1,845	3,229		2,768	
					Gravel and sand	1.00	398	398		341	
									34,227 00		29,338 00

Estimates for improving French Broad River, North Carolina, from Smith's Bridge to foot of Long Shoals—Continued.

Locality.	Distance above Smith's Bridge.	Length of shoals.		Maximum slope of improved water surface per mile.	Kind of material to be removed.	Cost per cubic yard.	Number of cubic yards.	For a channel 2¼ feet deep and 35 feet wide.		For a channel 2¼ feet deep and 30 feet wide.	
								Amount.	Total.	Amount.	Total.
	Miles.	*Miles.*	*Feet.*	*Feet.*							
Rice's Shoal	12⅓		3,505	9.19	Rock	$3.50	1,853	$6,486		$5,559	
					Rock and gravel	1.75	168	294		252	
Or foot of Long Shoals					Gravel and sand	1.00	174	174	$6,954 00	149	$5,960 00
									63,273 00		54,234 00
Contingencies, 20 per cent									12,654 75		10,846 80
Total									75,927 75		65,080 80

An improved channel, 35 feet wide and 2 feet deep, from Smith's Bridge to the foot of Long Shoal, a distance of 12⅛ miles, will cost $76,000. A channel of the same depth and a width of 30 feet for the same distance will cost $66,000.

Appropriations have been made as follows:

August 14, 1876	$10,000
June 18, 1878	15,000
March 3, 1879	5,000
June 14, 1880	3,000
March 3, 1881	5,000
August 2, 1882	5,000
The sum of all the appropriations is	43,000

By the acts of appropriation this sum was divided into two parts:

First. All the appropriations from August 14, 1876, until August 2, 1882, amounting to $38,000, were, by the direction of the act, to be expended on the part of the river between Brevard and Big Buck Shoal, a distance of about 30 miles.

Second. The appropriation made August 2, 1882, amounting to $5,000, was, by the direction of the act, to be expended between the foot of Long Shoal and Smith's Bridge, a distance of about 12 miles.

Smith's Bridge is near Asheville, N. C., and is about 46½ miles from Brevard, the head of the improvement. To complete the improvement from Brevard to Big Buck Shoal, according to the first estimate (see Report of Chief of Engineers, 1878), a further appropriation of $7,500 will be required. The expenditures upon this part of the river have extended through eight years, and this slow execution of the work has increased the contingent expenses beyond the amount usually assigned to this object. It is probable, however, that the sum last mentioned will be sufficient to complete the improvement of this part of the river.

For the improvement of the part of the river between Long Shoal and Smith's Bridge (35 feet wide and 2½ feet deep), according to the foregoing estimate, $76,000 will be required.

If Congress desires to continue the improvement between Brevard and Smith's Bridge, the appropriation might be divided as follows:

From Brevard to Big Buck Shoal, according to first estimate	$7,500
From the foot of Long Shoal to Smith's Bridge	16,500
Total	24,000

Money statement.

July 1, 1882, amount available	$9	08
Amount appropriated by act passed August 2, 1882	5,000	00
	5,009	08
June 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	1,364	60
July 1, 1883, amount available	3,644	48
Amount (estimated) required for completion of existing project	24,000	00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	24,000	00

COMMERCIAL STATISTICS.

The following statistics of trade for the year ending December 30, 1882, have been furnished by Mr. A. Cannon:

Beef and other cattle	$50,000
Dairy products	2,500
Fruits	10,000

Furs	$500
Grain	15,000
Lumber (sawed)	5,000
Poultry	1,000
Staves and barrel timber	1,500
Tobacco	10,000
Wool	10,000
Flour	25,000
Agricultural machines	5,000
Drugs and chemicals	15,000
Fertilizers	1,000
Furniture	3,000
Groceries	250,000
Hardware	25,000
Leather	3,000
Woven fabrics	250,000
Merchandise not included above	50,000
	732,500

The lumber business is one of great importance. Business of all kinds is on the increase, and with increased facilities for transportation will grow rapidly.

Mr. A. Cannon says "if the improvement, begun on the French Broad, should be completed it would create a new era in the business of this country. The work done is of a permanent character, and with an outlet to Asheville, will be a success."

APPENDIX K.

IMPROVEMENT OF THE HARBORS OF NORFOLK, VIRGINIA, AND BEAUFORT, NORTH CAROLINA; OF CURRITUCK SOUND, COANJOK BAY, AND NORTH RIVER AND BAR—IMPROVEMENT OF CERTAIN RIVERS IN VIRGINIA, NORTH CAROLINA, AND SOUTH CAROLINA.

REPORT OF CAPTAIN JAMES MERCUR, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1883, *WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

1. Harbor at Norfolk, Va., and its approaches.
2. Archer's Hope River, Virginia.
3. Pagan Creek, Virginia.
4. Blackwater River, Virginia.
5. Nottaway River, Virginia.
6. North Landing River, Virginia and North Carolina.
7. Meherrin River, North Carolina.
8. Currituck Sound, Coanjok Bay, North River and Bar, North Carolina.
9. Scuppernong River, North Carolina.
10. Pamplico and Tar rivers, North Carolina.
11. Neuse River, North Carolina.
12. Trent River, North Carolina.
13. Contentnea Creek, North Carolina.
14. Beaufort Harbor, North Carolina.
15. Cape Fear River, from Wilmington to Fayetteville, N. C.
16. Lillington River, North Carolina.
17. Town Creek, North Carolina.
18. Yadkin River, North Carolina.
19. New River, North Carolina.
20. Great Pee Dee River, South Carolina.
21. Waccamaw River, South Corolina.
22. Santee River, South Carolina.
23. Wateree River, South Carolina.
24. Georgetown Harbor, South Carolina.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., July 24, 1883.

GENERAL: I have the honor to transmit herewith annual reports upon the works of river and harbor improvement under my charge for the fiscal year ending June 30, 1883.

Very respectfully, your obedient servant,

JAMES MERCUR,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

K 1.

IMPROVEMENT OF HARBOR AT NORFOLK, VIRGINIA, AND ITS APPROACHES.

The object of this improvement has been fully set forth in previous annual reports, and is, in brief, to secure a channel not less than 25 feet deep and 500 feet wide at ordinary low water, from the deep water of

Hampton Roads to the harbor and to the United States navy-yard at Gosport, immediately above on the south branch of the Elizabeth River; to improve the harbor proper by dredging at the mouth of the Eastern Branch and for some distance above, and to dredge off the slopes of the flats at Portsmouth and Berkley, in order to restore, to some extent, the cross-sectional area and anchorage ground which have been lost during recent years.

For details of the operations of previous years, I respectfully refer to the Annual Reports of the Chief of Engineers for 1878, 1879, 1880, 1881, and 1882.

The act of Congress approved March 3, 1881, appropriated $75,000 for this work.

A project for the expenditure of this sum was submitted to the Chief of Engineers and duly approved. In accordance therewith proposals were invited for the dredging of 600,000 cubic yards of material, more or less. The lowest bidder was Mr. Thos. P. Morgan, jr., at 14 cents, with whom a contract was entered into for the work, to be completed June 30, 1882.

Mr. Morgan commenced operations October 15, 1881, and continued them up to the close of the fiscal year 1881–'82, at which time he had removed only 218,466 cubic yards, or only a little more than one-third of the amount of the contract. It had previously become evident that Mr. Morgan would be unable to complete his contract within the specfied time. He asked for an extension of six months. His application was referred to the Chief of Engineers, who granted an extension for one month, pending which the subject should receive more full consideration. This time was afterwards extended to November 4, 1882.

Under these extensions Mr. Morgan continued dredging in the bar off Sewall's Point, with from one to three clam-shell dredges, until November 4, when, the contract not having been completed, nor the conditions under which the temporary extension was granted complied with, it expired by its own limitation. From July 1 to November 4 there were removed 118,191 cubic yards of material, but one of the dredges, the Commodore, which was engaged from September 19 to November 2, inclusive, made the excavations entirely too deep. An examination made after her showed that there would have to be deducted 10,111 cubic yards for this cause, which reduced the quantity to 108,080 cubic yards credited to the contractor.

Under this contract there were removed:

	Cubic yards.
To June 30, 1882	218,466
After June 30	108,080
	326,546

Of this quantity Mr. Morgan was paid for 326,230 cubic yards, leaving forfeited to the United States, for failure to complete contract, 316 cubic yards, and, in addition, the 10 per centum retained on payments.

The river and harbor act of August 2, 1882, appropriated $75,000 for continuing this work. A project for the expenditure of this sum having been approved by the Chief of Engineers, proposals were invited for the excavation of 500,000 cubic yards, more or less. The proposals were opened December 22. The lowest bidders were the National Dredging Company, at 16.9 cents per cubic yard, with whom a contract was entered into, the work to be completed November 30, 1883.

Operations were commenced January 5, 1883, with one clam-shell

dredge, to which were added, during the month, three other large clam-shell machines. These four dredges continued work until March 19, when one was withdrawn. The remaining three continued work until taken off, as follows: One, April 6; one, April 19; and the remaining one, April 25. During May and June the work was continued with one dipper-dredge in some hard material in the inner harbor. The cause assigned for withdrawing all the larger dredges before completing contract was, that it would necessitate the sheathing of all the plant to prevent the ravages of the teredo, should they stay during the hot months, and that they had ample time to complete contract after the summer months. With the large plant at their disposal, this statement seems reasonable. They have been notified to expect no extension of time.

Up to this time the work accomplished has been to complete a channel about 14,000 feet long and about 200 feet wide in the bar opposite Sewall's Point, the dredging of nearly the entire area, 1,350 by 375 feet, in the Eastern Branch, off the Norfolk and Western Railroad Wharves, to a depth of 25 feet at low water, a little dredging in the South Branch, and a large amount of dredging near Town Point to enable large vessels to reach wharves recently erected.

The amounts removed from the above-named localities under the existing contract are as follows:

	Cubic yards.
From Eastern Branch, Elizabeth River	91,843
From South Branch, Elizabeth River	18,942
From vicinity Town Point	134,231
From Sewall's Point Bar	178,994
Total	424,010

All the material from East and South branches and Town Point was deposited on the flats on and near Craney Island. The material from Sewall's Point Bar was deposited inside Willoughby Spit.

Since the original estimates were made, the conditions upon which they were based have materially changed, owing to increased commerce necessitating new wharves and increased anchorage room in the harbor. The aggregate appropriations approach nearly (within $18,000) to the original estimates, but expenditures have been made in localities not originally contemplated.

The channel secured through Sewall's Point Bar having a minimum width of 200 feet and depth of 25 feet, being well buoyed and free from cross-currents, is believed to be ample for the large ships visiting the port, and will be much more apt to preserve its depth than if it were wider, owing somewhat to less diffusion of scour, but more to compelling the action of the screws of the deep-draught vessels upon the bottom to be confined to a narrow path. No further widening of this channel is contemplated.

The crowded condition of the harbor has caused a demand for the removal of the naval anchorage and dredging a new one, and the scarcity of wharf accommodations renders desirable the construction of wharves along the Berkley shore line and has led to petitions for dredging the Berkley flats. Should this work be undertaken, appropriations beyond the original estimates will be required. This work, as well as several others, has been under the immediate supervision of Mr. George H. Elliott, assistant engineer, who has conducted them with marked efficiency and ability.

The appropriations for this work have been:

August 14, 1876	$35,000
June 18, 1878	50,000
March 3, 1879	75,000
June 14, 1880	50,000
March 3, 1881	75,000
August 2, 1882	75,000
	360,000

Money statement.

July 1, 1882, amount available		$49,015 98
Amount received from sale of fuel to Capt. James Mercur		67 50
Amount appropriated by act passed August 2, 1882		75,000 00
		124,083 48
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$81,902 52	
July 1, 1883, outstanding liabilities	8,998 28	
		90,900 80
July 1, 1883, amount available		33,182 68
Amount (estimated) required for completion of existing project		18,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		75,000 00

Abstract of proposals received for dredging at Norfolk Harbor, Virginia, opened immediately after noon of December 22, 1882.

No.	Names and addresses of bidders.	Date of commencement.	Date of completion.	Price.
				Per cu. yd.
1	Morris & Cuming's Dredging Company, New York, N. Y.	Jan. 10, 1883	.....	$0 17 5/16
2	George C. Fobes & Co., Baltimore, Md	Feb. 1, 1883	Nov. 30, 1883	17 3/8
3	*Potomac Dredging Company, Washington, D. C	.....	.....	14
4	Moore & Wright, Portland, Me	Feb. 1, 1883	Nov. 30, 1883	18
5	†R. G. Packard, president Atlantic Dredging Company, Brooklyn, N. Y.	.....	.....	17
6	F. B. Colton, general manager National Dredging Company, Wilmington, Del.	Jan. 15, 1883	Nov. 30, 1883	16 2/16

*Proposal not in accordance with the specifications; rejected.

†Bid made on condition that towing can be done at any time, night or day, when tides and weather permit.

Contract with National Dredging Company.

STATEMENT OF PRINCIPAL ARTICLES SHIPPED FROM THIS PORT TO FOREIGN PORTS DURING THE FISCAL YEAR ENDING JUNE 30, 1883.

Cotton	bales..	365,445
Staves	number..	5,042,842
Shingles	M..	425,300
Lumber	feet..	40,061
Rum shooks	bundles..	395
Old shook	do...	500
Walnut logs	number..	190
White-oak logs	do...	193
Treenails	do...	11,800
Manganese	tons..	2,217
Corn	bushels..	383,382
Grain	bags..	80,672
Bark	tons..	50
Bricks	number..	2,800

	Number.	Tonnage.
Vessels entered from foreign ports	64	29,572
Vessels cleared for foreign ports	135	112,529
Vessels entered coastwise	1,314	1,248,461
Vessels cleared coastwise	818	1,099,266

Value of free goods entered, foreign	$100,153 43
Value of dutiable goods entered, foreign	67,003 35
Value of exports	18,201,759 00

G. E. BOWDEN,
Collector.

NORFOLK, VA., *July* 2, 3, 1883.

LETTER OF THE NORFOLK AND PORTSMOUTH COTTON EXCHANGE.

NORFOLK AND PORTSMOUTH COTTON EXCHANGE,
Norfolk, Va., July 28, 1883.

DEAR SIR: In response to yours of the 18th I herewith send statement showing receipts and shipments of cotton at this port for twelve months ending June 30, 1883.

RECEIPTS.

	Bales.
Received at Norfolk from 30th June, 1882, to 30th June, 1883	805,799

SHIPMENTS.

Shipped direct to Great Britain and continent	370,221
Shipped to coastwise ports	416,138
Total shipments	786,359

In furnishing this statement it affords me pleasure to call your attention to the fact that the cotton movement for the twelve months ending 30th June, 1883, is the largest record yet made at this port.

I remain, dear sir, yours respectfully,

NORMAN BELL,
Superintendent and Secretary.

MR. GEORGE H. ELLIOTT,
Assistant Engineer.

K 2.

IMPROVEMENT OF ARCHER'S HOPE RIVER, VIRGINIA.

The improvement proposed for this river is the dredging of a channel not less than 50 feet wide at bottom and 6 feet deep at low water, where these dimensions are not found from the mouth of the river where it empties into the James River to the city of Williamsburg, 5 miles above.

The work was commenced in 1882 under an appropriation of $5,000, made by the act approved March 3, 1881.

The act of August 2, 1882, appropriated $5.000 for continuing this work. A project for expending this sum was approved by the Chief of Engineers August 24.

Proposals for doing the work were invited and opened October 25. The lowest bidder was Mr. H. E. Culpepper, at 32 cents, but, as this bid was not in proper form, the honorable the Secretary of War ordered that it be rejected and the work readvertised, which was done.

The bids were opened December 22. The lowest bidders were James Caler & Son, at 27½ cents, with whom contract was entered into.

The work was to have been commenced in April, but the contractor was allowed to delay until May, on the 7th of which month a dredge was put on and continued until June 19, when, the funds being nearly exhausted, work was necessarily suspended.

A cut, which was left incomplete under previous contract, was finished, and three other cuts, in a direction nearly at right angles to the first cuts, and directly toward the mouth, were made up to the inner bulkhead; 16,524 cubic yards of material were excavated and deposited on the other side of the James River.

The work was finally examined immediately after work was suspended.

While the work done is of some benefit to navigation, it is very slight, and will necessitate, to properly utilize it, the opening of channels in the creek, particularly at and near the mouth, where there are hard sand bulkheads.

The work has been under the immediate supervision of Mr. George H. Elliott, assistant engineer.

This work is in the collection district of Yorktown, Va.

Money statement.

July 1, 1882, amount available		$107 97
Amount appropriated by act passed August 2, 1882		5,000 00
		5,107 97
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$4,838 76	
July 1, 1883, outstanding liabilities	75 00	
		4,913 76
July 1, 1883, amount available		194 21
Amount (estimated) required for completion of existing project		9,400 70
Amount that can be profitably expended in fiscal year ending June 30, 1885		9,400 70

Abstract of proposals received for dredging at Archer's Hope River, Virginia, opened immediately after noon of December 22, 1883.

No.	Names and addresses of bidders.	Date of commencement.	Date of completion.	Price.
				Per cu. yd.
1	James Caler & Son, Norfolk, Va	April 1, 1883	June 30, 1883	$0 27½
2	Potomac Dredging Company, Washington, D. C.	At once	Within specified time	30
3	George E. Ward, Alexandria, Va	April 1, 1883	June 30, 1883	28 9/10
4	Jos. Baker, Norfolk, Va		June 30, 1883	37½

Contract with James Caler & Son.

K 3.

IMPROVEMENT OF PAGAN CREEK, VIRGINIA.

The river and harbor act passed August 2, 1882, made no appropriation for this work.

There have been no operations during the fiscal year.

Pagan Creek is in the collection district of Norfolk, Va.

The appropriations for this work have been:

June 14, 1880	$5,000
March 3, 1881	5,000

Money statement.

July 1, 1882, amount available		$177 53
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		177 53
Amount (estimated) required for completion of existing project		18,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		18,000 00

K 4.

IMPROVEMENT OF BLACKWATER RIVER, VIRGINIA.

The act of Congress of March 3, 1881, appropriated $1,500 for the improvement of this river, which it was proposed to expend in cutting off obstructing points, a project to this effect having been approved by the Chief of Engineers.

Owing to the great expense attendant on procuring the necessary dredging machinery the work was deferred until July, 1882, when a dredge, which had been employed on another improvement, was moved to this work, remaining until the 22d of the month, when, the appropriation being nearly exhausted, and that for the current fiscal year not being made, operations were suspended.

The work accomplished was cutting off at what is known as Littleton's Bend, 1½ miles below Franklin, an abrupt point 75 feet long, from 8 to 12 feet wide, and 9 feet below the water level. The work was done by the hire of machinery and labor in open market.

The act of August 2, 1882, appropriated $1,500 for continuing this work. A project for its expenditure was approved August 24. The conditions in regard to the hire of machinery being the same as during the previous year, no work has yet been done. It is expected, however, to take it up shortly in connection with another work in the vicinity.

The work has been under the immediate supervision of Mr. George H. Elliott, assistant engineer.

The Blackwater River is in the collection district of Norfolk, Va.

The appropriations for this work have been:

June 18, 1878	$5,000
March 3, 1879	2,500
June 14, 1880	3,500
March 3, 1881	1,500
August 2, 1882	1,500

Money statement.

July 1, 1882, amount available	$1,490	36
Amount appropriated by act passed August 2, 1882	1,500	00
	2,990	36
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	1,385	93
July 1, 1883, amount available	1,604	43
Amount (estimated) required for completion of existing project	850	00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	1,000	00

K 5.

IMPROVEMENT OF NOTTOWAY RIVER, VIRGINIA.

No appropriation was made for this work in the river and harbor act passed August 2, 1882.

The acts approved June 14, 1880, and March 3, 1881, appropriated together $7,000, and operations in clearing the river of obstructing trees, logs, snags, &c., were conducted under an approved project from Au-

gust 17, 1881, until early in February, 1882, when work was suspended owing to high water. (Report of the Chief of Engineers for 1882.)

An examination made since operations have ceased shows that owing to the loose manner in which logs and timber are rafted the river above the Seaboard and Roanoke Railroad Bridge is in little, if any, better navigable condition than at the commencement of operations.

The navigation is confined to flat-boats, bateaux, and rafts. No increase in commerce seems to have followed the improvement.

The Nottoway River is in the collection district of Norfolk, Va.

Money statement.

July 1, 1882, amount available	$579 70
July 1, 1883, amount available	579 70
Amount (estimated) required for completion of existing project	2,000 00

K 6.

IMPROVEMENT OF NORTH LANDING RIVER, VIRGINIA AND NORTH CAROLINA.

The act of August 2, 1882, appropriated $8,000 for this work.

A recommendation as to the expenditure of this sum in dredging, where necessary to secure the channel as originally proposed, 80 feet wide at bottom and 9 feet deep at ordinary low water, and also to clear the channel of obstructing logs, snags, and trees, was approved by the Chief of Engineers August 28, 1882.

There have been no operations during the fiscal year, as, until recently, there was no immediate necessity, and it was then decided to defer the work until cooler weather, owing to the prevalence of malaria.

This river is a connecting link in the line of interior water communication south from Norfolk, Va., *via* the Albemarle and Chesapeake Canal.

The work is in the collection district of Norfolk, Va.

Statistics for the work, which also relate to Currituck Sound, are appended, having been furnished by the president of the Albemarle and Chesapeake Canal Company, Hon. Marshall Parks.

This work has been under the immediate supervision of Mr. George H. Elliott, assistant engineer.

The appropriations for this work have been:

March 3, 1879	$25,000
June 14, 1880	15,000
March 3, 1881	7,500
August 2, 1882	8,000
	55,500

Money statement.

July 1, 1882, amount available	$1,250 92
Amount appropriated by act passed August 2, 1882	8,000 00
July 1, 1883, amount available	9,250 92
Amount (estimated) required for completion of existing project	32,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	25,000 00

Statement of number and class of vessels passed through the Albemarle and Chesapeake Canal from July 1, 1882, to June 30, 1883.

Year and month.	Steamers.	Schooners.	Sloops.	Barges.	Lighters.	Boats.	Rafts.	Total.
1882.								
July	281	228	72	45	18	42	28	714
August	261	166	74	43	16	42	28	630
September	203	60	20	38	13	3	23	360
October	242	61	4	54	10	.....	19	390
November	276	67	11	42	8	2	20	416
December	280	69	19	41	11	2	19	441
1883.								
January	258	121	28	43	5	3	13	471
February	249	131	35	41	9	5	23	493
March	259	119	33	58	15	2	20	506
April	273	106	23	59	16	1	23	501
May	278	130	28	84	24	5	26	575
June	280	68	15	44	16	4	30	457
Total	3,040	1,316	362	592	161	111	272	5,954
North	1,515	656	180	298	97	52	272	3,070
South	1,525	660	182	294	64	59	.....	2,884
Total	3,040	1,316	362	592	161	111	272	5,954

Statement of leading items of produce received through the Albemarle and Chesapeake Canal from July 1, 1882, to June 30, 1883.

Year and month.	Cotton.	Fish.	Naval stores.	Bacon.	Wood.	Railroad ties.	Potatoes.	Cooper logs.
1882.	*Bales.*	*Barrels.*	*Barrels.*	*Pounds.*	*Cords.*	*Number.*	*Bushels.*	*Cords.*
July	127	125	895	13,860	14	6,023	4,041	168
August	123	67	871	10,573	54	9,359	1,259	320
September	1,484	111	1,062	6,885	363	12,390	2,275	333
October	12,578	22	1,241	11,570	31	10,000	2,951	278
November	15,795	196	1,007	22,600	355	2,677	8,517	288
December	18,660	272	523	23,900	111	3,880	682	215
1883.								
January	8,160	284	1,739	32,500	52	800	1,191	203
February	9,774	293	804	18,850	60	3,525	1,022	95
March	6,576	610	1,466	16,050	.....	4,066	2,146	146
April	2,450	1,426	682	14,400	100	19,173	6,548	559
May	1,961	2,665	641	11,990	128	14,185	5,388	615
June	272	69	1,008	13,800	.....	6,370	28,123	200
Total	77,960	6,140	11,939	196,978	1,268	92,448	64,243	3,420

Year and month.	Corn.	Peas and beans.	Lumber.	Shingles.	Stores.	Wheat.	Rice.
1882.	*Bushels.*	*Bushels.*	*Feet.*	*Number.*	*Number.*	*Bushels.*	*Bushels.*
July	16,948	213	6,465,243	2,233,140	1,400	1,600	.....
August	8,290	224	6,540,067	2,555,000	1,650	2,805	.....
September	2,836	452	6,205,405	2,634,900	12,250	3,817	.....
October	5,267	1,067	4,314,031	2,112,150	6,800	664	469
November	504	432	5,913,494	1,568,850	.....	436	8,280
December	19,883	78	3,784,883	1,316,700	400	75	9,414
1883.							
January	85,756	305	3,262,869	1,027,800	1,400	.....	1,339
February	96,839	948	4,579,401	1,425,100	2,300	200	4,701
March	69,955	394	4,841,240	2,477,650	500	.....	310
April	31,526	96	5,860,025	2,435,850	36,800	.....	6,320
May	32,376	600	8,080,293	2,608,450	7,500	14	8,050
June	7,885	655	8,370,279	3,700,859	2,600	.....	1,610
Total	377,565	5,464	78,216,230	24,996,449	63,600	9,611	40,493

K 7.

IMPROVEMENT OF MEHERRIN RIVER, NORTH CAROLINA.

The act of Congress passed August 2, 1882, appropriated $5,000 for this improvement.

A project for the expenditure of this sum was submitted to the Chief of Engineers August 18, 1882, and approved February 10, 1883. This project contemplated the removal of all snags, logs, sunken and overhanging trees which obstructed navigation.

Owing to the difficulty of hiring the necessary working plant, nothing was done until early in June, when preparations were made for commencing work. Active operations were begun at the mouth of the river on the 28th of the month, and to the close of the fiscal year two large and three small trees, sixteen logs, two snags, and one imbedded pile were taken out of the river bed.

The work has been done by the hire of labor and machinery in open market.

The work has been under the immediate supervision of Mr. George H. Elliott, assistant engineer.

The Meherrin River is in the second collection district of North Carolina.

Money statement.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, outstanding liabilities	163 19
July 1, 1883, amount available	4,836 81
Amount (estimated) required for completion of existing project below Murfreesborough	7,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	7,500 00

K 8.

IMPROVEMENT OF CURRITUCK SOUND, COANJOK BAY, AND NORTH RIVER BAR, NORTH CAROLINA.

This work is a connecting link in a line of inland navigation to the South *via* the Albemarle and Chesapeake Canal, and was commenced under an appropriation of $20,000, made by act of Congress June 18, 1878, for the improvement of Currituck Sound and North River Bar. The original plan of improvement adopted was the dredging of a channel 80 feet wide at bottom and 9 feet deep at an ordinary winter stage of water through the entire length of the upper part of Currituck Sound, about 10½ miles. For the details of previous operations your attention is respectfully invited to the Reports of the Chief of Engineers for 1879, 1880, 1881, and 1882.

The river and harbor act of August 2, 1882, appropriated $20,000 for this work. A project for the expenditure of this sum, which contemplated dredging and also the purchase of oyster-shells for the repair and preservation of the shell dike across Coanjok Bay, was approved by the Chief of Engineers, and in accordance therewith proposals were

invited for the removal of 80,000 cubic yards, more or less, in Coanjok Bay.

The proposals were opened October 25. The lowest bidder was Mr. Virginius Freeman, at 25 cents per cubic yard, with whom a contract was entered into, the work to be completed June 30, 1883. One of the conditions of this contract was that such of the material as was deemed necessary should bedeposited behind the shell bank across Coanjok Bay.

The work was commenced January 3, 1883, with one dipper-dredge, to which was added on the 25th a rotary-dredge. These two dredges continued working to the close of the fiscal year, but were considerably delayed by break-downs and by having to suspend operations for passing boats, the cut through the bay, where they were working, being quite narrow. The work accomplished has been the dredging of two cuts for nearly the entire distance across the bay, about 10,000 feet. The cuts aggregate 40 feet in width, and are excavated to the requisite depth, 9 feet. Thirty-seven thousand four hundred and forty-one cubic yards of material have been removed, which has all been deposited behind the shell dike.

Owing to the delays to which the contractor was subjected, he found himself unable to complete the contract within the specified time, and requested an extension of three months, which was granted by authority of the Chief of Engineers.

The shell dike across the west side of the bay had suffered somewhat from the severe storms of the winter and spring, and to strengthen it and increase its height at some points 26,826 bushels of oyster-shells were purchased, at 5½ cents per bushel, in open market, and placed upon it where. needed. To protect the northeast end of the bank, at the extreme end of the cut across the bay, 160 linear feet of sheet-piling were driven.

As other work has been added to that originally estimated for, it will be necessary to increase the estimates to accomplish all the work contemplated.

This work has been under the immediate supervision of Mr. George H. Elliott, assistant engineer.

This work is in the collection district of Norfolk, Va.

The appropriations for the work have been:

June 18, 1878	$20,000
March 3, 1879	25,000
June 14, 1880	25,000
March 3, 1881	30,000
August 2, 1882	20,000
	120,000

Money statement.

July 1, 1882, amount available		$1,127 41
Amount appropriated by act passed August 2, 1882		20,000 00
		21,127 41
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$12,686 33	
July 1, 1883, outstanding liabilities	1,394 57	
		14,080 90
July 1, 1883, amount available		7,046 51
Amount (estimated) required for completion of existing project		20,213 95
Amount that can be profitably expended in fiscal year ending June 30, 1885		20,200 00

Abstract of proposals received for dredging at Currituck Sound and Coanjok Bay, North Carolina, and opened immediately after noon of October 25, 1882.

No.	Names and addresses of bidders.	Date of commencement.	Date of completion.	Price measured in scows.	Price measured *in situ*.	Remarks.
				Per cu. yd.	*Per cu. yd.*	
1	H. E. Culpepper, Portsmouth, Va.	Dec. 15, 1882	June 30, 1883	$0 27½	$0 29½	Bidder's bond not signed and improperly made out.
2	Virginius Freeman, Norfolk, Va.	Dec. 20, 1882	June 30, 1883	25	25	
3	James Caler & Son, Norfolk, Va.	Jan. 15, 1883	June 30, 1883	38	48 23	At Currituck Sound. At Coanjok Bay.

Contract with Virginius Freeman.

K 9.

IMPROVEMENT OF SCUPPERNONG RIVER, NORTH CAROLINA.

There was no appropriation for this work in the act of Congress of August 2, 1882.

There have been no operations during the fiscal year.

Scuppernong River is in the collection district of Albemarle, N. C.

The appropriations for the work have been:

June 18, 1878	$2,000
March 3, 1879	2,000
June 14, 1880	1,000
March 3, 1881	1,000
	6,000

Money statement.

July 1, 1882, amount available	$10 64
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	10 64
Amount (estimated) required for completion of existing project	2,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	2,000 00

K 10.

IMPROVEMENT OF PAMPLICO AND TAR RIVERS, NORTH CAROLINA.

The river and harbor act of August 2, 1882, appropriated $10,000 for the improvement of these rivers. Work under this appropriation has been carried on in accordance with the approved project, which contemplates securing a deep water navigation of 9 feet at low water so far as Washington, N. C., and clearing the Tar of obstructions, and contracting its channel at points by jetties, to secure a light draught navigation of about 20 inches, for as much of the year as is possible, up to Tarborough.

The continued high water in the river has enabled the steamers to run to Tarborough during about ten months of the last fiscal year, and has prevented continued work or building jetties. A working party has, however, trimmed the banks of the Tar of overhanging trees, &c., from Tarborough down to Greenville, and has removed some logs and stumps from the channel.

Two jetties, aggregating 160 feet in length, have been built at Red Bank, and two others repaired. The working plant has been repaired and put in good order, and one new flat-boat was built.

The Pamplico River being in good navigable condition, with a channel of a minimum width of 108 feet and 9 feet depth, no work has been done upon this stream, and none is contemplated in the immediate future.

The supervision of this work has been intrusted to Mr. John P. Darling, assistant engineer, who has conducted it with zeal and ability. The continuance of high water making work upon the river impracticable during a part of the year, Mr. Darling, under orders from this office, has, at such times, discharged his working party, and, after repairing the plant and placing it in charge of a watchman, has been engaged upon surveys, thus reducing expenditures to a minimum.

A copy of Mr. Darling's report, giving a sketch of the work and a statement of the commerce of Washington, N. C., the chief town upon these rivers, is appended hereto.

The appropriations for the work have been:

June 14, 1880	$9,000
March 3, 1881	8,000
August 2, 1882	10,000
	27,000

Money statement.

July 1, 1882, amount available		$2,069 28
Amount appropriated by act passed August 2, 1882		10,000 00
		12,069 28
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,906 75	
July 1, 1883, outstanding liabilities	26 00	
		3,932 75
July 1, 1883, amount available		8,136 53
Amount that can be profitably expended in fiscal year ending June 30, 1885.		12,000 00

REPORT OF MR. JOHN P. DARLING, ASSISTANT ENGINEER.

WASHINGTON, N. C., *June* 30, 1883.

CAPTAIN: I have the honor to submit the following annual report of the improvements on Pamplico and Tar rivers, North Carolina, for the fiscal year ending June 30, 1883.

All the work done during the year has been on the Tar River, the Pamplico not badly needing any further improvement at present, having a channel of 108 feet least width, and 9 feet depth.

The field work of the survey of Tar River, which was in progress at the date of my last annual report, was completed on the 17th of July, and my report and map, with estimate for further improvement, was completed and sent in about the last of August.

On the 24th of July the plant went up the river, and work was commenced on jetties below Greenville, and continued, with frequent interruptions from freshets, until the 31st of August, when the water became so high that work was stopped until the 16th of October, and then recommenced at the same place, but on the 23d the water again rose, and work on the jetties had to be stopped and left unfinished.

I then had the quarters towed up the river to Tarborough, and the banks trimmed from there down to Greenville. All the overhanging trees, limbs, and logs that would interfere with navigation, or that would fall into the channel thereafter, were cut and removed from the banks. Also some stumps and logs were removed from the channel. As we have no hoister on the work, there were a great many left which could not be moved with our appliances. The work of trimming the banks was completed December 23.

During January and February the old plant was repaired and one new flat built, since which nothing has been done on account of the continued high water in the Tar, except caring for Government property. There has not been, altogether, more than two months in the last year that the steamers could not run through to Tarborough.

There are four Tar River steamers now, the Old Dominion Company having built and put another on the river within the last year.

Two jetties were put in at Red Banks, containing 160 linear feet, and two just below were repaired and refilled, the water having scoured out at the outer end and washed them up. The number of trees and stumps cut and removed from the banks was 979, and a great quantity of small trees and limbs. The number of trees and logs taken out of the channel was 42.

The water has not been low enough as yet to ascertain what improvements in the channel the jetties have made in the last year.

The following shows the amount of commerce from June 30, 1882, to June 30, 1883:

Lumber	feet..	6,128,555
Shingles		2,288,525
Cotton	bales..	31,807
Rice	bags..	20,197
Mill feed	do...	3,402
Naval stores	barrels..	9,514
Potatoes	do...	2,500
Staves		7,300
Miscellaneous	pounds..	401,058
Amount of foreign importations		$53,000

The shipments of all the articles enumerated, except cotton, naval stores, and staves, have increased from one-third to one-half in the last year. The falling off in cotton is partly due to the short crop and to the planters holding for a better market.

I am, captain, very respectfully, your obedient servant,

JNO. P. DARLING,
Assistant Engineer.

Capt. JAS. MERCUR,
Corps of Engineers, U. S. A.

K 11.

IMPROVEMENT OF NEUSE RIVER, NORTH CAROLINA.

The river and harbor act of August 2, 1882, appropriated $35,000 for the improvement of this stream, "five thousand dollars of which shall be applied to the improvement of the line of inland navigation from New Berne to Beaufort Harbor."

An uncertainty existing as to which route of inland navigation this appropriation should be applied, no part of the $5,000 has yet been expended.

Work has been continued on the Neuse in accordance with the approved project, which contemplated clearing the river of trees, logs, and snags to the head of navigation at Smithfield, and securing a depth of 4 feet at low water as far as Kinston.

The progress made in clearing the river of trees during the year has been very satisfactory, the working party having pushed the improvement up to Smithfield and returned to below Goldsborough, removing any obstructions which had been overlooked or which had fallen in the river after the party passed up.

The jettying has been retarded by long-continued high water, rendering it impracticable to work during a great part of the year.

Up to November 1, 1882, a steam-hoister was hired on this river, in addition to two owned by the United States; but the progress of the work rendering this hoister unnecessary, it was discharged at that date.

During the year 2,331 long logs and trees, 1,879 small logs and trees, and 340 stumps have been taken from the channel; 4,988 large trees and 8,743 small trees have been cut from the banks.

Between Kinston and "Becton's Old Field" there have been built 3,812 running feet of jetties, such as were described in previous reports. These jetties and those previously built continue to give satisfaction, and have needed very few repairs, notwithstanding the continued high water.

Navigation for boats drawing not more than 3 feet is now practicable to Smithfield, 175 miles above New Berne, for more than half the year, and for shallower draught much longer. When the jetties below Kinston are completed it is expected to have a 4-foot channel to this place at all stages of the river.

An annual appropriation of from $5,000 to $10,000 will, however, be required to maintain the navigation of the river in good order.

The amount of increase in commerce over this and adjacent streams under improvement by the United States can be estimated by the fact that while five years ago but one steamer ran from New Berne, there are now nine, and one or two more building.

This work has been under the immediate supervision of Mr. R. Ransom, assistant engineer, who has conducted this, as well as the four other works intrusted to him, with marked zeal, ability, and success. A copy of his report is appended, to which, with accompanying commercial statistics, your attention is respectfully invited.

The appropriations for the work have been:

June 18, 1878	$40,000
March 3, 1879	45,000
June 14, 1880	45,000
March 3, 1881	30,000
August 2, 1882	35,000
Total	195,000

Money statement.

July 1, 1882, amount available		$11,392 56
Amount appropriated by act passed August 2, 1882		35,000 00
		46,392 56
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$22,609 27	
July 1, 1883, outstanding liabilities	1,001 80	
		23,611 07
July 1, 1883, amount available		22,781 49
Amount (estimated) required for completion of existing project		13,761 84
Amount that can be profitably expended in fiscal year ending June 30, 1885		30,000 00

REPORT OF MR. R. RANSOM, ASSISTANT ENGINEER.

NEW BERNE, N. C., *June* 30, 1883.

CAPTAIN: I have the honor to submit the following report showing the progress and condition of work upon Neuse River during the past year.

Clearing the stream of obstructions from the point reached at the date of my last report was continued up to Smithfield, a distance of 23 miles, and that town was reached on the 15th of May. During the year 2,331 large logs and trees, 1,897 small logs and trees, and 340 stumps have been taken from the channel, and 4,988 large trees and 8,743 small ones cut from the banks.

After arriving at Smithfield the working party, much reduced in number, was turned back and has proceeded down stream, taking out what needed removing, and has now passed the railroad bridge near Goldsborough. Within thirty days I expect this force to join the other, and both to be putting in jetties below Kinston.

Since June last there has been built, between Kinston and the vicinity of "Becton's Old Field," 3,812 feet of jetties, such as described in former reports. The protracted stage of high water prevented more being put in.

The 1st of November the force and machinery from this part of the stream were transferred to the Contentnea, and, after leaving that stream, the hired machine was discharged, and the other was employed for a short time taking out some obstructions in the "Let Alones," caused by extensive caving of the banks. The water still remaining too high for jettying, work was recommenced near the mouth of the Contentnea, on that stream, in what is known as the "Narrows."

It is gratifying to be able to report the continued satisfactory action of the jetties in the Neuse. Few have been at all injured, as far as is observable now, by the long and heavy freshets.

I think from 8,000 to 10,000 feet more of jetties will be required, and, so soon as the stage of water will permit, that kind of work will be resumed.

Smithfield is about 175 miles above New Berne, and is the limit of practicable navigation. To that point boats drawing 3 feet of water can go for more than half the year, and those of shallower draught a much longer period.

To keep the river in good order will require an annual expenditure of perhaps $5,000. For so long a distance that would be a very moderate sum ordinarily, while exigencies might demand much more.

I will not discuss the possibilities of trade and commerce in the event of opening a channel to the sea from this stream via Clubfoot and Harlow creeks and Beaufort Harbor.

Below is a partial list of produce, &c., passed through New Berne in the last year, and I beg to call attention to the item of cotton in 1879 and this year as illustrative of the growth of this region, and very much of which is attributable to the improvement of river navigation. Five years ago one small steamer ran upon these streams. Now there are nine, and one or two building.

As heretofore the work has been done by hired labor and some hired machinery, and supplies and material have been bought in open market.

It will probably be necessary before winter to have a general repair of our plant, for time and hard work have had their effect.

Very respectfully, your obedient servant,

R. RANSOM,
Assistant Engineer.

Capt. JAMES MERCUR,
U. S. Engineers.

COMMERCIAL STATISTICS.

NEW BERNE, N. C., *July* 5, 1883.

CAPTAIN: Below please find table of some of the leading articles shipped from this place during the past year:

Cotton	bales..	49,560
Corn	bushels..	333,000
Rice	do...	177,000
Rice	tierces..	1,757
Lumber	feet..	12,453,000
Shingles		3,915,000
Wooden plates		15,000,000
Cotton-seed meal	tons...	700
Cotton-seed oil	gallons..	33,000
Naval stores	barrels..	8,500
Fresh fish	pounds..	2,500,000
Salt fish	barrels..	2,500
Cotton yarn	bales..	2,800
Canned oysters	cases..	8,600
Fruit	barrels and packages..	225,000

Many articles in smaller quantities are not enumerated. Mr. George B. Guion, president of Board of Trade says, in a letter giving some of these statistics:

"Although the crops of the past year were not full ones, our greatly increased facilities for navigation produced by the Government improvement of our streams have enabled to increase the commerce of New Berne beyond the hopes of the most energetic and zealous of our merchants."

* * * * * * *

Very respectfully, your obedient servant,

R. RANSOM,
Assistant Engineer.

Capt. JAMES MERCUR,
U. S. Engineers.

LETTER OF COLLECTOR OF CUSTOMS AT NEW BERNE, NORTH CAROLINA.

CUSTOM-HOUSE, NEW BERNE, N. C.,
Collector's Office, June 9, 1883.

SIR: In compliance with your request, I herewith present the commercial statistics of this collection district for the last fiscal year ending June 30, 1883:

	Number.	Tons.
Vessels entered from foreign ports	8	1,001
Vessels cleared for foreign ports	9	1,176
Vessels entered coastwise	326	170,543
Vessels cleared coastwise (no record).		
Total value of domestic exports		$11,753 00
Total value of dutiable imports		10,041 80
Total amount of duty collected		3,005 95

Very respectfully,

THOS. A. HENRY,
Collector,
By L. W. HANCOCK,
Deputy Collector.

General ROBERT RANSOM.

K 12.

IMPROVEMENT OF TRENT RIVER, NORTH CAROLINA.

The river and harbor act of August 2, 1882, appropriated $10,000 for the improvement of this river.

Under this appropriation operations were begun in November, 1882, and continued during that month, December, and January. During this time about 600 large trees and 1,200 smaller ones were cut from the banks and 73 logs were taken from the channel.

The most important work remaining to be done consisting in dredging, the working party was discharged and an effort was made to secure a dredge suitable for the work. This has not been practicable up to this time, as the draw in the railroad bridge at New Berne is too narrow to admit a dredge of the ordinary width passing through, and the narrow dredges throughout the country, from Norfolk to the South, were all engaged upon other works and were not available.

It is hoped that a suitable dredge may soon be hired, when the dredging will be carried so far as the funds remaining on hand admit.

This work has been under the supervision of Mr. R. Ransom, assistant engineer, a copy of whose report is appended hereto.

Money statement.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$1,557 38	
July 1, 1883, outstanding liabilities	40 00	
		1,597 38
July 1, 1883, amount available		8,402 62
Amount that can be profitably expended in fiscal year ending June 30, 1885.		25,000 00

REPORT OF MR. R. RANSOM, ASSISTANT ENGINEER.

NEW BERNE, N. C., *June* 30, 1883.

CAPTAIN: I have the honor to submit the following brief statement of what has been done upon Trent River since the date of my last annual report:

The main work to be done is dredging. It has not been practicable to secure a suitable dredge boat, large ones not being suited to the work, and all kinds demanding high prices and difficult to employ. Perhaps it may be beneficial in the end to have been forced to delay this kind of the work, for, if an appropriation sufficient to complete it could be secured, the improvement would be made to much greater advantage in every respect.

With such appliances as we could devise out of the means at disposal, about 600 large trees and twice the number of small ones were cut from the banks, and 73 logs were taken from the channel during the months of November, December, and January last. There remains very little of this latter class of improvement to be accomplished. Since January nothing has been done, and only one man has been employed to care for the property.

The president of Trent River Transportation Company says, in a letter to me dated June 21, 1883:

"Notwithstanding an outbreak of small-pox at Trenton just at the busiest season, causing almost a total suspension of business for sixty days, the traffic of the river has kept pace with the very marked improvement of the country along the stream since the beginning of Government work upon it, this improvement being indicated by the greatly increased products, the largely enhanced value of lands and other property, educational and religious advantages and social advancement."

My last report so fully expresses my opinions regarding what should be done on Trent River that I will not repeat.

Very respectfully, your obedient servant,

R. RANSOM,
Assistant Engineer.

Capt. JAMES MERCUR,
U. S. Engineers.

K 13.

IMPROVEMENT OF CONTENTNEA CREEK, NORTH CAROLINA.

The river and harbor act of August 2, 1882, appropriated $10,000 for the improvement of this stream.

Work began in November last, and continued, when the state of the river made it practicable, until the end of the fiscal year. Owing to this stream emptying into the Neuse, and work on one being at times practicable while it is not advisable on the other, the working parties and plant are transferred from one stream to the other when this course leads to economy and efficiency in carrying on the work.

The work of clearing the stream of logs and trees has been carried to Snow Hill, about 45 miles up the river, and a large amount of work has been done in the crooked and difficult part of the river near its mouth, known as the "Narrows."

During the season there have been removed from the channel 785 large logs, 969 small logs, and 1,028 stumps; 568 large trees and 3,570 small ones have been cut from the banks. The improvement of the stream is most marked, and the benefit to commerce very great for the money expended. Steamers now run regularly upon this stream, and carry large quantities of produce to New Berne and a market.

Mr. R. Ransom, assistant engineer, has had the supervision of this work. A copy of his report is appended hereto.

Contentnea Creek is in the second collection district of North Carolina.

The appropriations for this work have been:

March 3, 1881	$10,000
August 2, 1882	10,000

Money statement.

July 1, 1882, amount available		$306 01
Amount appropriated by act passed August 2, 1882		10,000 00
		10,306 01
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$8,421 64	
July 1, 1883, outstanding liabilities	1,014 25	
		9,435 89
July 1, 1883, amount available		870 12
Amount (estimated) required for completion of existing project		20,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		20,000 00

REPORT OF MR. R. RANSOM, ASSISTANT ENGINEER.

NEW BERNE, N. C., *June* 30, 1883.

CAPTAIN: I have the honor to submit the following report of work done upon Contentnea Creek since my last annual statement.

On the 1st of November last the plant and force upon the lower Neuse were transferred to the Contentnea. There was a little done near the mouth of the creek towards clearing away the numerous stumps. The water rose suddenly, and the machinery was towed part of the way to where work stopped the last season. Suddenly the water fell, and some time was lost in getting to the working point. By the 1st of March the stream was cleared effectually to Snow Hill, a distance of about 45 miles from its mouth. The force was then turned back and worked when occasion required over the distance from Snow Hill to its mouth. During April and May the water was too high to permit effective work near the mouth, but during June much has been accomplished towards clearing that difficult part of the stream called the "Narrows." During this season's operations 785 large logs, 969 small logs, and 1,028 stumps have been taken from the channel, and 568 large trees and 3,570 small ones cut from the banks. In a few weeks the appropriation will be exhausted, but the beneficial results obtained are not easily calculated. Steamers now run daily where two years ago they were unknown and unexpected. No similar amount expended has wrought more benefit unless, perhaps, upon the Trent. A liberal appropriation to complete what should be done on this stream is confidently and earnestly recommended. My last report fully sets forth my convictions regarding it. The increased commerce passing through New Berne is greatly facilitated by the clearing of this stream. The vouchers in your office show the expense of the work done. Every effort has been made to economize in expending the appropriation. This being a tributary of the Neuse, sends its products over the latter stream for about 30 miles.

Very respectfully, your obedient servant,

R. RANSOM,
Assistant Engineer.

Capt. JAS. MERCUR,
U. S. Engineers.

K 14.

IMPROVEMENT OF BEAUFORT HARBOR, NORTH CAROLINA.

The river and harbor act of August 2, 1882, appropriated $30,000 for the improvement of this harbor, "five thousand dollars of which shall be applied to the improvement of the line of inland navigation from Beaufort Harbor to New Berne."

The route of inland navigation to be improved not being specified, no expenditure of this $5,000 has been made pending the determination of the route to the improvement of which it should be applied.

Operations for the improvement of Beaufort Harbor have been carried on in accordance with the project approved for the expenditure of the appropriation, made in the river and harbor act of March 3, 1881, which was to build one or more jetties, as might be necessary, for the protection and building out of Shackleford Point, which had been badly cut away by tides and storms, endangering the stability of the main ship channel and exposing the town of Beaufort to the direct action of storms.

One jetty was commenced, and extended 30 feet, at the beginning of the fiscal year. This has been extended to a length of 535 feet, with a width of 30 feet at bottom and with a varying height, which places the top, for 200 feet from shore, level and 6 feet above high-water mark. From this point the top slopes uniformly to the outer end, which is between high and low water.

The foundation mattresses are made of logs 30 feet long, and not less than 15 inches at the butt, fastened together with cross-ties, spiked to each log with 9-inch wrought-iron spikes.

The first 300 feet of the jetty has caused the sand to accumulate until it is level with its top, making a fill of about 10 feet, while for the rest of the jetty the sand is nearly level with its top. It is proposed to build the outer part of this jetty up to the level of its inner portion, and possibly extend it still further, and to build additional sand-catch fences, similar to 2,800 feet which has already been constructed, with a view to building up the point to as near its former dimensions as may be. It is also proposed to attempt the formation of sand dunes along the shore by planting the long beach-grass in rows and patches along the shore.

A scouring action having set in on the inner side of the banks, a short jetty, about 100 feet long, was built to stop the action. This has been, in part, successful, but the scour still continues on the Core Sound side of it, and will necessitate further action for bank protection if it continues.

In carrying on this work at a point where there were absolutely no facilities, it has been necessary to build two scows 30 feet by 14 by 3 feet, a landing stage or wharf, a tramway with strap-iron rails, over 1,000 feet long, 400 feet of which is trestle, and several cars; to buy a sail-boat, and charter a tug-boat for handling scows.

The stone, a part of which came by rail and part by sailing vessels, had to be handled in some cases two or three times before it could be placed in position. This necessarily increased the cost of the work, but it is believed that under the efficient management of Mr. R. Ransom, assistant engineer, the expenses have been kept at the lowest possible point.

A copy of Mr. Ransom's report, with a tracing showing the location and effect of the work, is inclosed herewith. The trade of Beaufort is confined almost entirely to fish, terrapin, and shell-fish. No statistics of shipments are available. Beaufort is a port of entry.

Appropriations for this work have been:

March 3, 1881	$30,000
August 2, 1882	30,000

Money statement.

July 1, 1882, amount available		$25,897 09
Amount appropriated by act passed August 2, 1882		30,000 00
		55,897 09
July 1, 1883, amount expended during the fiscal year, exclusive of outstanding liabilities July 1, 1882	$31,313 95	
July 1, 1883, outstanding liabilities	2,513 75	
		33,827 70
July 1, 1883, amount available		22,069 39
Amount (estimated) required for completion of existing project		22,103 38
Amount that can be profitably expended in fiscal year ending June 30, 1885		22,100 00

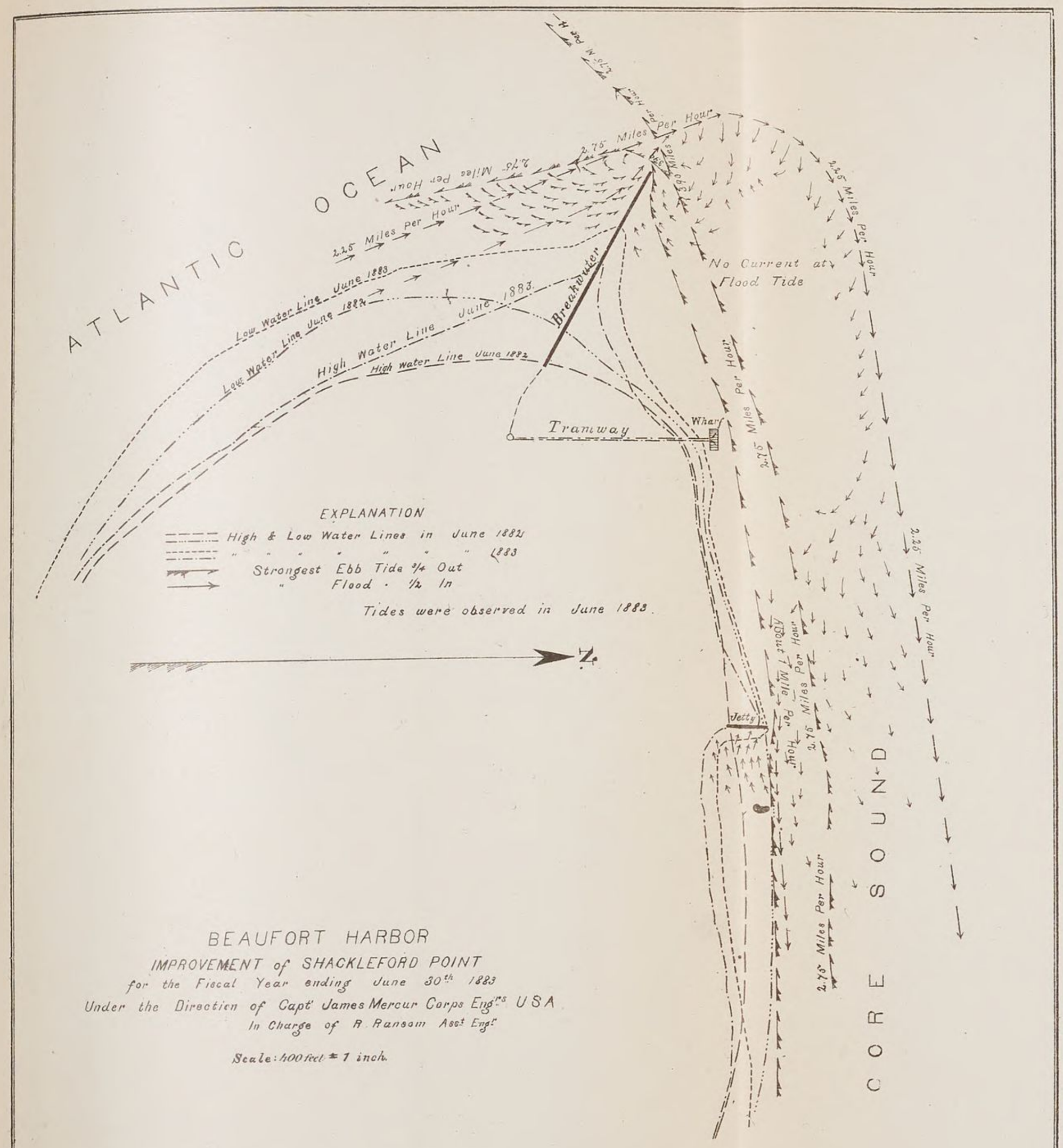
REPORT OF MR. R. RANSOM, ASSISTANT ENGINEER.

NEW BERNE, N. C., *June* 30, 1883.

CAPTAIN: I have the honor to make the following report of work done during the past year for the improvement of Beaufort Harbor, in furtherance of the project adopted:

In addition to what was done preparatory to work, two scows, 30 by 14 by 3 feet, were built. A temporary platform, or wharf, to receive stone, and a tramway over 1,000 feet long, more than 400 feet of which is trestle, and all ironed with strap iron, were constructed.

The exposed position of the breakwater and the dangerous shoals over which it passes, made the use of scows to transport stone immediately to it almost impossible



BEAUFORT HARBOR

IMPROVEMENT of SHACKLEFORD POINT

for the Fiscal Year ending June 30th 1883

Under the Direction of Capt James Mercur Corps Engrs USA

In Charge of R Ransom Asst Engr

Scale: 400 feet = 1 inch.

the greater part of the time; hence the necessity for the wharf and tramway and four tram cars.

There has been built 535 feet in length of a breakwater 30 feet wide at the base, and varying in height from the base, although the upper surface in length is level for over 200 feet, and then slopes to the outer end, which is bare at low water but covered at high tide. The base of the jetty is upon log mats 30 feet long and not less than 15 inches across the butt, 15 logs to the mat, the logs fastened by cross-ties, each nailed with wrought iron spikes 9 inches long. The mats are in from one to three layers, according to the depth of water. It was necessary to lay the mats rapidly to evade the formation of holes at the outer end, for the whole breakwater is built on shifting sand, which each tid- seems to move until it is fixed by something which catches and holds it. The first 300 feet of the work has accumulated sand to its top, and now where water flowed 4 feet deep within 30 feet of the head of the breakwater the sand is 6 feet above high water. The stone slopes in a rounded form form the base, 30 feet wide, to the top, about 5 feet wide. It is proposed to carry the top of the breakwater level its entire length, and it is believed that sand will form over it throughout, judging from what has taken place.

It was observed that erosion occurred about 1,000 feet up Core Sound from the breakwater, after the work had progressed to nearly its extreme limit, and it was decided to put in a secondary work at or near that point. This consis s of a jetty 100 feet long, 15 feet wide at base, and 5 feet wide at top, raised 1 foot above high water, and built similarly to the main work.

There have been used 1,800 logs and 4,369 cubic yards of stone, the stone varying in weight from 15 to 300 pounds to the piece.

The cost of 1,890 yards of the stone brought to Morehead wharf was a cent or two under $4 the cubic yard. The cost of the remainder was $2.50 the cubic yard on our scows or platforms. There is now at Shackleford Point about 800 yards of stone for use.

Owing to various causes, the want of everything needed to begin the work and inability to get anything near by, the exposed position, the violent winds and dangerous shoals, and, for months, very inclement weather, all combined to retard progress and make the work costly. But the very uncommon results produced so speedily, far more than meeting our most sanguine hopes, as shown by the stability of what is done and the very great accretion, more than counterbalance what may appear to be expensive construction.

Accompanying this are tracings showing the position of the breakwater, the secondary jetty, and the route of the tramway, together with the high and low water lines now and one year ago, and the direction of flood and ebb current.

I respectfully suggest that if the main breakwater be extended from 200 to 300 feet as already built that nothing further will be required to effectually save Shackleford Point from further encroachment.

It is apparent that the destruction heretofore occurring has been by the *outflowing* tide, and it is suggested that water entering at Hatteras finds outlet at Beaufort.

From recent observations made with an old ship's log and line the greatest velocity of the ebb tide between the jetty 1,000 feet above the breakwater and a point 100 feet from the breakwater was determined to be 2.75 miles the hour. From this last point the current is deflected, and takes up a velocity of 3.90 miles per hour till it passes a short distance beyond the breakwater, and there resumes the 2.75 rate. The directions of the flood and ebb currents are given on the tracings. These observations were taken during comparative calms, and cannot be received as indicating maximum velocities. The average rise of tide is 3.0 feet, and the maximum observed in the last year was 5.5 feet. The least water on the bar has been 16 feet, and the least in channel up Core Sound to the jetty is 6 feet at very lowest tide.

It is proper to state that a greater part of the stone was received in the dead of winter and had to be handled twice as often as, under other circumstances, would have been necessary.

In addition to the work mentioned, 2,800 feet of brush-fence, from 4 to 5 feet high and a foot thick, to act as a sand-catch, was put up and is now covered to the top with sand.

All the work has been done with hired labor and material bought in open market. Believing we could dispense with the tug, early in May it was discharged.

While I have given strict attention and general supervision and direction to this work, it has been faithfully and well executed under the immediate charge of Mr. Reid Whitford, a young engineer, whom I commend to you as worthy of professional consideration whenever his services may be needed.

Very respectfully, your obedient servant,

R. RANSOM,
Assistant Engineer.

Capt. JAMES MERCUR,
U. S. Engineers.

K 15.

IMPROVEMENT OF CAPE FEAR RIVER FROM WILMINGTON TO FAYETTEVILLE, NORTH CAROLINA.

The river and harbor act of August 2, 1882, appropriated $30,000 for this river.

Under the approved project, which contemplates the removal of all trees, snags, &c., from the channel, trimming the banks of overhanging trees, and contracting the current for scouring shoals, the steam-hoister and its scows have been employed, when the stage of the river allowed, in taking up sunken obstructions; parties of laborers have been employed trimming the banks, and extra scows and pile-drivers, and a light-draught steamer, for use when the water is too low to allow the regular steamers to run, have been under construction and are nearly complete.

The most dangerous obstructions have been removed from the river between Wilmington and Fayetteville, except for a distance of 19 miles between Little Sugar Loaf and Kelly's Cove, the water being so high when the machinery passed this stretch that the obstructions were not visible. Numerous sunken trees, &c., still remain in the river, and many come in at each large freshet. These, covered with sand, are frequently not seen until, by the removal of others, a scour is developed which brings them in sight. The number washed into the stream will be diminished by continued trimming of the caving banks, but a yearly appropriation will be needed so long as the banks of the river remain wooded and the overhanging and falling trees have no value to the land-owners.

The continued high water has kept the navigation good for almost the entire year, and has prevented the beginning of the jetties for contracting the stream, but the plant being now ready operations will commence so soon as the stage of the water permits.

There have been removed from the channel during the year 1,569 sunken trees, 1,496 stumps, 1,454 logs, and 4,154 snags; 5,614 trees were cut from the banks. The work has been done by hired labor and purchase of material in open market.

This, as well as several other works, has been under the supervision of Mr. W. H. James, assistant engineer, to whom my thanks are due for the manner in which they have been conducted. A copy of his report, giving details of the work and commercial statistics, is submitted herewith.

The Cape Fear River is in the collection district of Wilmington, N. C.

The appropriations for the work have been:

March 3, 1881	$30,000
August 2, 1882	30,000

Money statement.

July 1, 1882, amount available		$15,186 04
Amount appropriated by act passed August 2, 1882		30,000 00
		45,186 04
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$10,344 60	
July 1, 1883, outstanding liabilities	2,642 85	
		12,987 45
July 1, 1883, amount available		32,198 59
Amount (estimated) required for completion of existing project		5,755 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		25,000 00

REPORT OF MR. WILLIAM H. JAMES, ASSISTANT ENGINEER.

WILMINGTON, N. C., *July* 1, 1883.

CAPTAIN: I have the honor to submit the following report of operations on improvement of Cape Fear River between Wilmington and Fayetteville, N. C., during the year ending June 30, 1883:

* * * * * * *

Between Fayetteville and Cypress Landing, 56 miles below, there are twenty-two shoals, troublesome to navigation at low water to a greater or les·er extent, and all of which need treatment by means of dikes, jetties, and wing-dams for contracting and scouring out the channel at these points and making the best of it at low stages of water. It is proposed to enter upon this work as soon as the stage of water is sufficiently low. During the past year the work consisted in clearing the channel of the river of obstructions of trees, stumps, logs, snags, &c., and of trimming or removing from its banks overhanging trees liable to be undermined and to fall into the river or to injure the upper works of steamers in passing abrupt points or bends in times of very high or very low water.

The necessary appliances for constructing jetties have been provided, including pile-driver, floating quarters, lumber, and a suitable scow for transporting material for jetties.

A side-wheel steam launch, 60 feet long, with 10 feet beam, to draw about 12 inches of water, has been built, and is nearly ready for use, in towing plant and materials for jetties, carrying supplies, and in visiting and supervision of works.

During the year there were taken out of the channel of the river 1,569 sunken trees, 1,496 stumps, 1,454 logs, and 4,154 snags and 5,614 overhanging trees were trimmed or removed from its banks. The work done has greatly added to the safety and facility of navigation. Through the summer and fall of 1882 the rainfall was quite good, as it has been thus far the present season, and there has consequently been but little inconvenience experienced from low water since the summer and fall of 1881.

The freshets of the last winter and spring brought down a great number of trees, logs, snags, stumps, slides, and other obstructions into the channel, much of which, however, has been cleared out. It is only to be expected that such obstructions will come in every successive winter and spring, and that a moderate amount of work in removing them will be required year after year.

Between Wilmington and Fayetteville the river has been cleared of the worst and most dangerous obstructions of trees, logs, snags, and stumps, except for the distance of about 19 miles between "Little Sugar Loaf" and "Kelly's Cove," the water having always been too high, in passing up or down this stretch, for work, except trimming and removing overhanging trees from the banks. Great numbers of obstructions still remain in the channel, especially at the crossings of shoals.

It is often found, after removing such obstructions at these shoals, that the current uncovers other layers of logs, &c., underneath, and that, in some cases, they having caused the formation of such shoals, their complete removal may materially lessen the amount of jettying that has appeared to be required at such points.

From Fayetteville down to Wilmington the banks of the river have been pretty well trimmed and cleared of overhanging trees, but a great number of trees, estimated at 8,000, are being undermined by freshets, and being liable, at such times, to come or slide into the river, they should be removed. A great proportion of sunken logs and other obstructions being hidden, and it being impossible to foresee the number and extent of jetties that will be required, or their effect on the channel, beneficial or otherwise, when constructed, no accurate estimate can yet be made of the amount of further appropriations that will be required to put the river in good order for low-water navigation.

A further appropriation of $12,000, in addition to balance remaining of previous appropriations, could be advantageously applied to continuing work on this improvement up to July 1, 1885.

Very respectfully, your obedient servant,

WM. H. JAMES,
Assistant Engineer.

Capt. JAMES MERCUR,
Corps of Engineers, U. S. A.

STATEMENT OF COTTON, NAVAL STORES, AND TIMBER BROUGHT TO WILMINGTON, NORTH CAROLINA, BY WAY OF THE CAPE FEAR RIVER, FOR THE YEAR ENDING MAY 31, 1883.

Spirits turpentine	barrels..	25,487
Resin	do...	97,516
Tar	do...	18,877
Crude turpentine	do...	5,065
Cotton	bales..	15,198
Timber	feet..	36,540,480

The cotton and naval stores above came by steamers. A considerable quantity, in addition, of cotton and naval stores, of which no record has been kept, as also of firewood, shingles, &c., came by scows and rafts.

Respectfully submitted.

WM. H. JAMES,
Assistant Engineer.

Capt. JAMES MERCUR,
Corps of Engineers, U. S. A.

Total exports from the port of Wilmington, N. C.

Year ended December 31—	Cotton.	Spirits.	Resin	Tar.	Crude.	Lumber.	Pitch.
	Bales.	*Casks.*	*Barrels.*	*Barrels.*	*Barrels.*	*Feet.*	*Barrels.*
1873	39,650	131,236	690,151	45,326	15,225	19,517,768	8,421
1874	64,562	125,837	556,182	68,619	15,595	7,229,625	7,483
1875	71,263	107,420	523,330	47,159	8,294	9,820,607	4,176
1876	102,884	91,592	49[illegible],555	61,891	5,435	14,698,632	6,078
1877	113,733	101,832	537,704	69,981	6,032	17,024,061	5,283
1878	130,456	118,176	581,958	63,184	4,536	18,068,843	4,724
1879	83,738	91,224	512,891	67,372	2,905	23,887,693	8,659
1880	106,066	102,725	447,750	53,441	3,356	34,271,675	8,054
1881	125,429	87,658	486,138	60,491	2,437	45,498,480	9,266
1882	117,258	87,896	444,318	71,445	2,309	40,281,138	7,982

Year ended December 31—	Peanuts.	Cotton goods.	Yarn.	P. stock.	Shingles.	Spirits.	Tar.
	Barrels.	*Bales*	*Bales.*	*Bales.*	*Number.*	*Cases.*	*Cases.*
1873	.....	2,356	497	.....	6,338,836	.....	.....
1874	33,562	2,375	1,095	.....	8,501,213	376	717
1875	41,138	1,984	1,260	.....	5,189,200	225	770
1876	44,405	3,511	4,076	.....	4,889,780	453	1,515
1877	70,570	3,488	5,251	126	8,052,286	319	1,982
1878	101,281	2,417	6,405	368	6,834,808	269	3,185
1879	59,681	1,390	982	47	7,660,750	54	3,106
1880	71,813	683	130	100	6,627,537	125	4,948
1881	77,042	888	341	340	6,867,183	50	3,923
1882	58,885	1,376	576	741	6,635,851	116	6,341

The above tabular statement is from a report of "Information and statistics respecting Wilmington, N. C.," to the Wilmington Produce Exchange, by its president, James Sprunt, esq.

Respectfully submitted with annual report of July 1, 1883, on improvement of the Cape Fear River from Wilmington to Fayetteville, N. C.

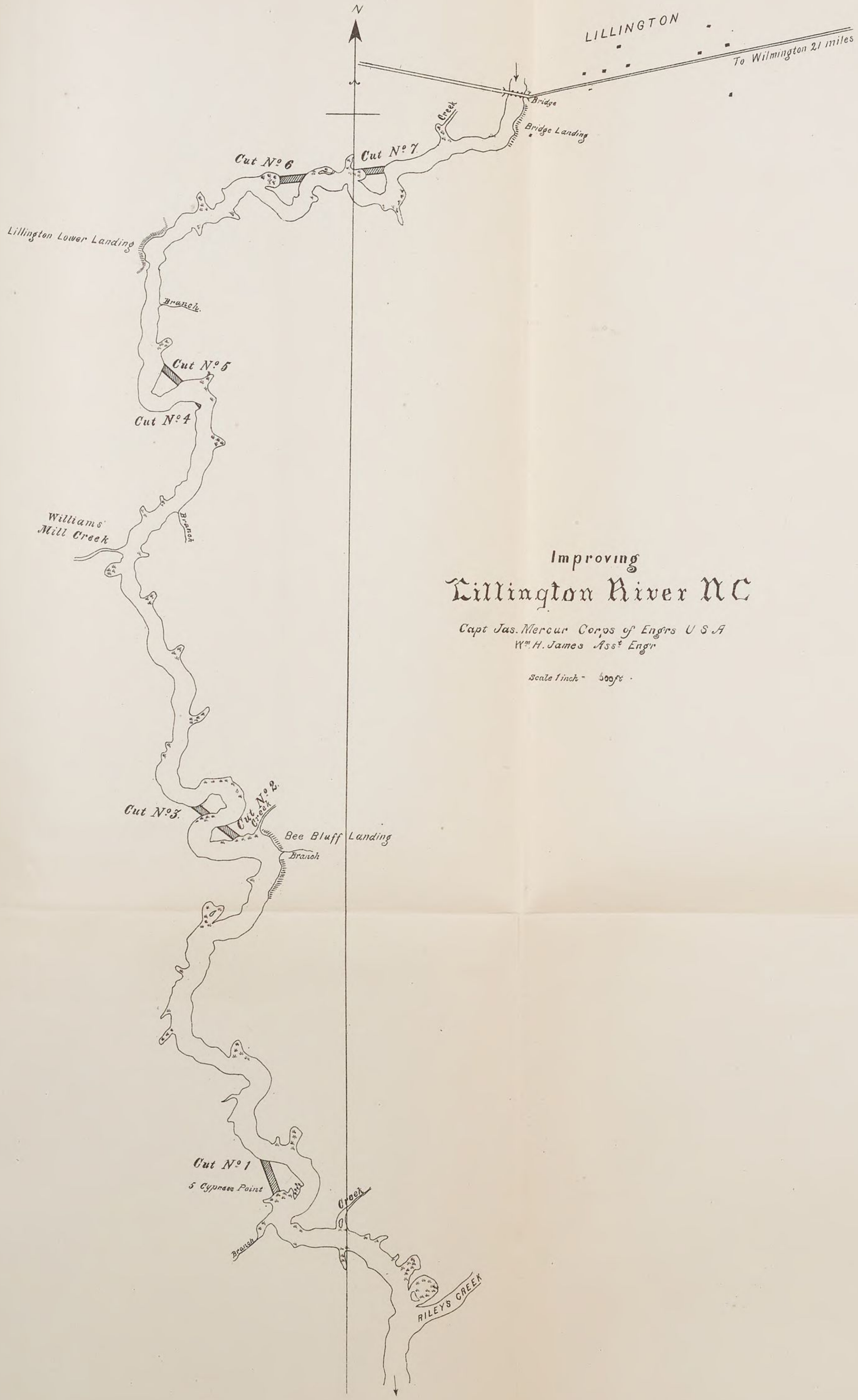
WM. H. JAMES,
Assistant Engineer.

Capt. JAMES MERCUR,
Corps of Engineers, U. S. A.

K 16.

IMPROVEMENT OF LILLINGTON RIVER, NORTH CAROLINA.

The river and harbor act of March 3, 1881, appropriated $3,000 for this work. Owing to difficulty in obtaining the necessary machinery, except at prohibitory rates, no expenditure of this money was made until the appropriation of $3,000 made by the river and harbor act of August 2, 1882, became available.



Improving

Lillington River NC

Capt Jas. Mercur Corps of Engrs U S A
Wm H. James Asst Engr

Scale 1 inch = 600 ft.

With these two appropriations to draw upon, and with the hoisting machinery, built for use on the Cape Fear River, available, work was commenced on this stream in December last under the approved project, which contemplated clearing the channel of sunken trees, snags, wrecks of flat-boats, &c., trimming the banks of overhanging trees, and cutting off certain sharp points by dredging channels through their necks, thus securing a navigable channel up to the town of Lillington, 11 miles above the mouth of the river.

The work of clearing the banks and channel was completed on March 18. A suitable dredge was obtained and commenced work on June 15, and has continued up to this time, having nearly completed the first cut, 238 feet long and 32 feet wide, with a depth of not less than 5 feet.

Owing to the large number of cypress roots penetrating the extremely soft soil in these cuts, the work is necessarily slow and quite expensive. It is believed, however, that the present appropriation will be sufficient to complete the work in accordance with the project.

This work has been under the supervision of Mr. W. H. James, assistant engineer, a copy of whose report, giving details of work done, and a tracing of that portion of the river in which obstructions exist, is submitted herewith.

This work has been done by hired labor and purchase of material in open market.

No regular line of boats runs on this river. No commercial statistics are available.

Lillington River is in the collection district of Wilmington, N. C., which is its nearest port of entry.

Money statement.

July 1, 1882, amount available		$3,000 00
Amount appropriated by act passed August 2, 1882		3,000 00
		6,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$2,254 75	
July 1, 1883, outstanding liabilities	644 15	
		2,898 90
July 1, 1883, amount available		3,101 10

REPORT OF MR. WILLIAM H. JAMES, ASSISTANT ENGINEER.

WILMINGTON, N. C., *July* 1, 1883.

CAPTAIN: I have the honor to submit annual report of work on improvement of Lillington River, North Carolina, for the year ending June 30, 1883, with accompanying traced map of Lillington River, from the town of Lillington down to the mouth of Rilley's Creek, a distance of 1.4 miles, showing in red, proposed cut-offs at several sharp bends in the river.

The act of Congress approved March 3, 1881, appropriated $3,000 to the improvement of this river, and the act passed August 2, 1882, appropriated a further sum of $3,000 for the same object.

Lillington River empties into the northeast branch of the Cape Fear River 12 miles above the city of Wilmington, and is navigable for about 11 miles up to the town of Lillington, carrying a depth of 7 to 50 feet for that distance, and a width of from 45 to 500 feet.

For about 1.4 miles below Lillington to Riley's Creek, the river is narrow and very tortuous. Below the mouth of Riley's Creek it is broad and deep, with easy bends.

The project under which work has been done included the removal from the channel of the river of two sunken flats and of all the obstructions of sunken trees, logs, snags, and stumps, and the trimming or removal from its banks of overhanging trees and the cutting off, by dredging, of several sharp bends between Lillington and the mouth of Riley's Creek, giving 5 feet navigation through these cut-offs. On December 12, 1882, a suitable floating steam hoister having been secured, and floating quarters and camel scow, and suitable tools and appliances provided, work was commenced

and continued until March 18, 1883, during which time all obstructions were removed from the channel of the river, and all troublesome overhanging trees trimmed or removed from its banks, and the sites of proposed cut offs cleared of trees, stumps, and undergrowth and made ready for dredging. In this work there were taken out from the river two sunken flats, two hundred and sixty-five trees, two hundred and thirty-eight logs, and eight hundred and sixty-three snags and six hundred and seventy-six stumps. Many of them blasted were taken out from the river or from the sites of proposed cut-offs.

All work being finished, except dredging through cut-offs, operations were suspended until a suitable dredge could be procured.

On June 15, 1883, such a dredge having been obtained, the work of dredging cut-offs was commenced at the five cypresses (cut No. 1). This cut, 238 feet long and 32 feet wide, has been nearly completed, with a depth at low water of from 5 to 10 feet and upwards. Under the water level the dredged material is very soft mud, filled and interlaced with roots, and many cypress stumps were encountered, which required blasting and dredging under them to get them out. The great number of cypress knees and sticks dredged made it necessary to clear the bucket by hand through most of the distance dredged. This cut, No. 1, includes nearly one-fourth of the entire work required for the seven cuts shown on the accompanying map. These cuts, once opened and cleared of stumps and roots, will be kept open, and widened and deepened by the currents of tides and freshets. The new dredged channel through cut-offs will be so direct that the width given (32 feet) will be ample for any boats navigating the Cape Fear waters, but the balance of appropriations remaining will probably suffice to add to the width, after carrying the 32-feet width through the seven cut-offs.

Very respectfully, your obedient servant,

WM. H. JAMES,
Assistant Engineer.

Capt. JAMES MERCUR,
Corps of Engineers, U. S. A.

K 17.

IMPROVEMENT OF TOWN CREEK, NORTH CAROLINA.

The river and harbor act of March 3, 1881, appropriated $1,000 for this stream.


Owing to the lack of suitable machinery and the impracticability of obtaining it, no work was done on this stream until the last year, when, by taking advantage of the plant constructed for use on the Cape Fear, during a term when high water prevented its use on that stream, and by hiring a dredge improvised from a hoister scow, operations were undertaken, by hired labor, and purchase of material in open market, to improve the creek in accordance with a project made for the expenditure of the small amount appropriated. This project, which was a modification of the original one published in the report of the examination of this stream in the Report of the Chief of Engineers for 1881, Appendix I 16, contemplated the removal of logs, snags, sunken flat-boats, &c., from the channel, and the most troublesome overhangine trees from the banks, and dredging, through three shoals, a narrow channel, of not less than 3½ feet at low water.

Under the efficient management of Mr. W. H. James, assistant engineer, this project has been completed to the satisfaction of those using flat and other light-draught boats in the creek, by the expenditure of the very small amount appropriated. A copy of his report, giving a detailed statement of work done, and a tracing showing its location, are submitted herewith. Great credit is due Mr. James for the amount of work done with the small appropriation available.

The original estimate for the improvement of this stream was $9,078.48, but it is believed that all necessary improvement could be made by a further appropriation of $2,000.

No commercial statistics are available for this stream, as its navigation has been restricted to flat-boats.

Town Creek is in the collection district of Wilmington, N. C.


Improving
TOWN CREEK N.C.
Capt Jas. Mercur Corps of Engrs. U.S.A.
Wm. H. James Asst. Engr.
Scale 1 inch = 200 ft
Shoal No 1
Shoal No 2
Shoal No 3
Island
Tar Landing
Russells Landing
Bridge
Note
Dredged Channels through Shoals Nos 1.2 & 3
are shown in heavy dotted lines.
Figures in black on Shoals indicate in feet a tenths
soundings at ordinary high water before dredging, at which
stage. Dredged Channel A.B. has now a depth of 3.5 ft
and B.C. D.E. and F.G. a depth of from 4.5 to 6 ft.

Money statement.

July 1, 1882, amount available	$1,000 00
July 1, 1883, amount enpended during fiscal year, exclusive of outstanding liabilities July 1, 1882	1,000 00
Amount (estimated) required for completion of existing project	8,078 48
Amount that can be profitably expended in fiscal year ending June 30, 1885.	2,000 00

REPORT OF MR. WILLIAM H. JAMES, ASSISTANT ENGINEER.

WILMINGTON, N. C., *July* 1, 1883.

CAPTAIN: I have the honor to submit annual report of operations on improvement of Town Creek, North Carolina, for the year ending June 30, 1883, with map accompanying, drawn to a scale of 100 feet to 1 inch, showing the location, extent, and character of shoals Nos. 1, 2 and 3, and, in heavy dotted lines, the channel dredged through them.

The river and harbor act approved March 3, 1881, appropriated $1,000 for the improvement of this stream. The proposed improvement consisted in the removal of sunken logs, trees, snags, and of two sunken flats, the removal from the banks of overhanging trees, and dredging out a channel giving 60 feet width and 4 feet depth, at low water, through four shoals between "Hog-Wallow Landing" and "Saw-Pit Landing," the head of navigation, 20¼ miles above the mouth of Town Creek.

The original estimate of cost for this improvement, based on a survey made in September, 1880 (a report of which appears in the Report of the Chief of Engineers for the year 1881, Appendix I 16), was $9,078.48.

The project under which the above appropriation of $1,000 has been expended was to remove obstructions of logs, snags, sunken flats, &c., from the channel, and the most troublesome overhanging trees from the banks of the stream, and to dredge through the three upper shoals above named a narrow but sufficient channel, of not less than 3½ feet depth at ordinary high water. This work has been completed, including the blowing up and removal from the channel of two sunken flats, taking out two hundred and seventy-four snags, forty-six logs, sixty sunken trees, and five stumps, one large one of which was blasted; removing from the banks sixty-four overhanging trees, trimming on banks two hundred and five trees, and dredging a channel of about 1,000 running feet of length through shoals Nos. 1, 2, and 3 to a width of 28 feet and upwards and a depth of 3½ to 6 feet at ordinary high water.

In shoal No. 1 some stumps and a great number of roots were encountered between the points A and B, which made it impossible, with the small amount of funds available, to obtain a greater depth, at high water, than 3.5 feet between these points. Through the balance of the dredged channel, BC, DE, and FG, a depth of 4½ to 6 feet has been given. Had means permitted, a much more direct channel through shoal No. 1 might have been opened between A and C, but a great number of roots and logs would have been encountered, and it was desirable to touch the rather important "Tar Landing."

The material dredged was of mud and sand, overgrown with bonnet plants, the flat leaves of which nearly covered the surface of the water. This material was deposited on the left (westerly) side of dredged channel, behind a revetment of gum logs, used to prevent its coming back into the channel.

By a further expenditure of from $1,800 to $2,000 the banks of the stream could be cleared of all troublesome overhanging trees, and a channel 40 feet wide and not less than 4 feet deep at low water could be dredged out and cleared through all shoals, from "Saw-Pit Landing" to "Hog-Wallow Landing." Between the shoals, and from the lowest shoal down to the mouth of the creek, there is a depth of from 7 to 25 feet at lowest stage of water.

The average rise and fall of tide at Shoal No. 1 is about 0.8. The upper portion of the stream being much of it quite wide (450 feet at some points), and much of the lower portion very narrow, the tidal currents are feeble and amount to but little in washing out the channel or keeping it open, across shoals, after dredging. In its present condition a considerable increase of the business done on Town Creek can reasonably be looked for, and, with the further improvements suggested, a very heavy increase may be counted on, in taking to market cotton, rice, and naval stores, &c., and in the distribution of supplies.

There are no accessible statistics of the business being done, the craft now navigating the creek not having to register at the custom-house.

"Saw-Pit Landing," the head of navigation, is 0.72 of a mile above "Russel's Landing," shown on accompanying map, and 20.25 miles above the mouth of Town Creek, where it debouches into the Cape Fear River, at the head of Big Island, 8 miles below the city of Wilmington.

Very respectfully, your obedient servant,

WM. H. JAMES,
Assistant Engineer.

Capt. JAMES MERCUR,
Corps of Engineers, U. S. A.

K 18.

IMPROVEMENT OF YADKIN RIVER, NORTH CAROLINA.

The river and harbor act of August 2, 1882, appropriated $25,000 for the improvement of this river.

Operations during the working season have been carried on under the approved project, which contemplates securing a channel for light-draught steamers from the North Carolina Railroad Bridge to Bean Shoal.

The obstructions to this river consist of rocks and shoals, and also of a number of mill-dams, which completely block all navigation until they are removed.

The law officers of the Government have decided that no part of the money appropriated for this river can be expended in purchasing right of way, or paying damages for passing through these dams, the owners of which have declined to allow them to be removed without compensation.

The improvement of the river is therefore limited to the 21½ miles which lie between the North Carolina Railroad Bridge and Swicegood's Mill-dam, the lowest on the river, and the operations now being carried on are designed for the improvement of this stretch of river, which being completed, it is not intended to undertake further work until free right of way is granted to the United States, or specific legislation causes the removal of the dams.

The character of the stream, the machinery used, and the obstructions to be removed are such that the laborers employed are obliged to work in water from 6 inches to 4 or 5 feet deep. This restricts the time of work to the season of warm weather and low water, making progress comparatively slow. During the last year, owing to an unusually protracted term of high water, the season of active operations was limited to about three months.

This work has been under the immediate supervision of Mr. W. H. James, assistant engineer, a copy of whose report, giving details of work done, with a map showing the location of the ledges and shoals, is forwarded herewith.

There is no navigation on the river at this time, and no commercial statistics are submitted. Should the improvement be complete, some parties have discussed the project of running a steamboat from the North Carolina Railroad Bridge up the river so far as practicable, but it is not thought that this project has taken any definite form as yet.

Money statement.

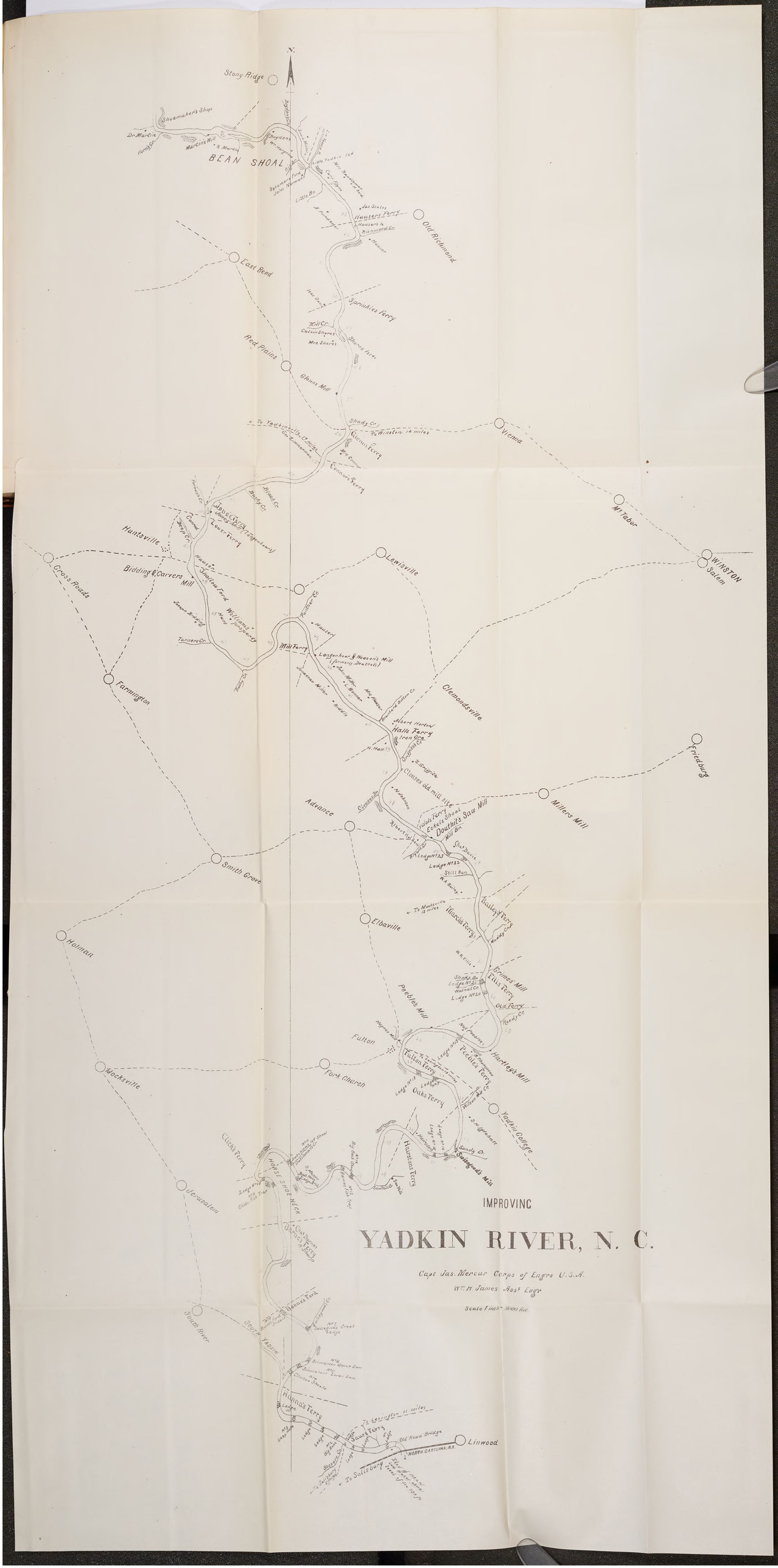
July 1, 1882, amount available		$17,935 20
Amount appropriated by act passed August 2, 1882		25,000 00
		42,935 20
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$9,061 88	
July 1, 1883, outstanding liabilities	1,001 43	
		10,063 31
July 1, 1883, amount available		32,871 89

REPORT OF MR. WILLIAM H. JAMES, ASSISTANT ENGINEER.

WILMINGTON, N. C., *July* 1, 1883.

CAPTAIN: The following annual report of work done on improving Yadkin River, North Carolina, for the year ending June 30, 1883, with a map of the Yadkin River from the bridge of the North Carolina Railroad to Bean Shoals, showing the points at which work has been done, is respectfully submitted.

This work has consisted in opening a channel giving 2½ feet navigation for eight


N.
Stony Ridge
Shoemaker's Shop
Dr Martin
Martins Mill
P. Martin
Boyden's
Hargrave's
BEAN SHOAL
Steamers Ferry
John Hammond
Little Br.
Old Yadkin R.
Mrs Hargrave's Ford
Corp. Spgs.
Jas Scales
Hausers Ferry
Hausers
Richmond Co.
Old Richmond
East Bend
Spruill's Ferry
Mill Cr.
Calvin Shipes
Mrs Sheets
Shores Ferry
Red Plains
Church Mill
Shady Cr.
To Winston 12 miles
To Yadkinville 12 miles
Geo Zimmerman
Glenns Ferry
Geo Grimes
Connors Ferry
Vienna
Mt Tabor
WINSTON
Salem
Huntsville
Yadkin Co.
Davie Co.
Davie & Yadkin Ferry (Farmers Ferry)
Lower Ferry
Davie Co.
Bidding & Carvers Mill
Hauser
Stanton Ford
Lewisville
Cross Roads
James Bidding
Williams Ford
Turners Cr.
Panther Cr.
Hauser
Mill Ferry
Longenbow & Hauser's Mill
(formerly Boutwells)
Johnson Miller
Bradle
Mary Hauser
Richmond Allison Co.
Albert Hanford
Halls Ferry
Iron Ore
Clemonsville
Farmington
N. Hall
Griffin
Griffin Cr.
Friedburg
Clarkes old mill site
Clarkes Cr.
Nicholson
Millers Mill
Advance
Tidals Ferry
Eckels Shoal
Doutties Saw Mill
Mill Br.
Albertings Cr.
Big Ledge No 23
Ledge No 22
Shed Davis
Still Run
N.A. Bailey
Smith Grove
To Mocksville 12 miles
Hargrave Ferry
Bailey's Ferry
Bailey Cr.
Elbaville
Holman
W.B. Ellis
Grimes Mill
Ellis Ferry
Shady Gr.
Ledge No 21
Walnut Cr.
Ledge No 20
Old Ferry
Peebles Mill
Reedy Cr.
Hwy Fences
Fulton
Fulton Ferry
Peebles Ferry
Hardey's Mill
Ledge No 19
Ledge No 18
Ledge No 17
Mocksville
Fork Church
Oaks Ferry
Yadkin College
Sandy Cr.
Sandy Creek Mill
Hargrove Ferry
Clicks Ferry
Hicks Shoe Neck
Jerusalem
Davie & Yadkin Ferry
Johnes Ferry
South River
South Yadkin
Ridings Ferry
Ledge
To Lexington 11 miles
Davie Ferry
Old Road Bridge
Linwood
NORTH CAROLINA R.R.
To Salisbury
IMPROVING
YADKIN RIVER, N. C.
Capt Jas. Mercur Corps of Engrs U.S.A.
Wm H. James Asst Engr
Scale 1 inch = 3000 feet.

months of the year through Swicegood's Creek Ledges, Boone's Shoals, and Click's Fish Dam, and commencing work through Barnes's Fish Dam Shoals, dredging channel at Big Rock Shoals, changing location of training-dikes at Boone's Ford Shoals, blasting and taking out bowlders near Click's Fish Trap Shoals, and building a jetty 126 feet long at this point for checking current, removing trees from Fish Dam at Barnes's Shoals, and building a jetty 110 feet long at that point, repairs of bottom, sides, deck, and roof of hoister-scows, and quarters, and other scows, repairs of mach nery and tools, and care of Government property during time of suspension of work. Sixty cubic yards of sand and gravel were dredged from channel at Big Rock Shoals, and at the other points named; 1,163 cubic yards of rock were blasted and removed, 646 holes, of 1,371 linear feet, drilled, 902 pounds dynamite consumed by 670 blasts made, and 226 running feet of wing-walls and jetties built, and the direction of 100 feet of training-walls changed at Boone's Ford Shoals. During the months of July and August, 1882, there was little interruption to work from bad weather and high water. There were heavy freshets in September, and owing to high and cold water, work, except repairs, was suspended for the season October 15, 1882.

Cold and high water prevented resumption of work until June 15, 1883. Thus there were only about three months of the twelve during which operations in the channel of the river could be prosecuted.

The Comptroller of the Treasury having decided that no part of the appropriations made for this improvement can be applied to payment of damages for destruction of mill property, and no provision having been made, or disposition shown by those interested in this improvement to make provision for payment of such damages, work has been necessarily restricted to that part of the river below Swicegood's Mill, the first one met with going up, and 21½ miles above the bridge of the North Carolina Railroad.

Under instructions contained in your letter of March 24, 1883, I was authorized and directed to go on and complete the improvement up to Swicegood's Mill, at a cost of $10,000. It is believed that this amount will be sufficient.

Very respectfully, your obedient servant,

WM. H. JAMES,
Assistant Engineer.

Capt. JAMES MERCUR,
Corps of Engineers, U. S. A.

K 19.

IMPROVEMENT OF NEW RIVER, NORTH CAROLINA.

Five thousand dollars were appropriated by the river and harbor act of August 2, 1882, for this river, the improvement of which is to consist entirely in dredging.

The estimated cost of dredging is $40,000, provided it be done under one contract, the price being necessarily high owing to the great danger attaching to taking dredging machinery to the site of the work, which can only be done by taking it out to sea and entering through New River Inlet, which is shoal and difficult.

The amount of the appropriation not justifying the commencement of operations no work has been undertaken, and it is not considered advisable to begin any work until a larger amount of money is available.

COMMERCIAL STATISTICS.

The commerce of this river is carried on by some small schooners of about 18 tons each. The approximate annual shipments are stated to be 20,000 barrels of naval stores, 1,500 bales of cotton, with an unknown amount of peanuts, fish, and oysters.

Money statement.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount available	5,000 00
Amount (estimated) required for completion of existing project	35,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	35,000 00

5455—E 83——55

K 20.

IMPROVEMENT OF GREAT PEE DEE RIVER, SOUTH CAROLINA.

The act of August 2, 1882, appropriated $6,000 for the improvement of this river.

Under the approved project this has been expended by hired labor and purchase of material in open market.

Work began in November, 1882, and continued until February, 1883, when the near exhaustion of the appropriation necessitated its stop.

During this time the banks were trimmed of overhanging trees at Fountain's Landing, Wild's Landing, Williamson's Landing, Nevel's Creek, Hunt's Bluff, Hennigan's Landing, and Buzzard's Bar, and a steam hoister was employed in removing sunken trees, logs, &c., between the mouth of the river and Smith's Mills, 47 miles above. The work was delayed and rendered more expensive by continued high water, but, so far as carried, affords great satisfaction to those navigating the river.

The work done on this river up to this time has enabled boats to ascend at low-water stages a distance of 50 miles further than they were able to do before the improvement began.

The original estimate for clearing the river of obstructions up to the head of navigation at Cheraw, based upon an examination made in 1880, was $25,520. In the progress of the improvement it has been found that a great many sunken obstructions existed which could not be discovered in the examination, necessarily hurried. The number of logs, for instance, in two of the bends improved has been found to equal the total number estimated in the entire river. The estimates for the completion of the improvement of the river must, therefore, be increased.

This work has been under the supervision of Mr. H. Heth, assistant engineer, a copy of whose report, containing a statement of shipments over the river, and an estimate of the cost of finishing the improvement is submitted herewith. This estimate of $25,300 is based upon an experience derived from three seasons' work upon the river, and may be considered as good as can be made. It is possible, however, that even this amount may be too small, as the number of trees, logs, snags, &c., can only be determined by their removal, the removal of those in sight frequently causing the sand to wash away and disclose others which were formerly concealed.

The improvement of the river has been followed by a continued increase in commerce and by great benefit to the farmers near its banks, since the river for a large part of its course is at some distance from the railroads, and the country through which it runs is difficult for transportation in wagons.

The Great Pee Dee is in the collection district of Georgetown, S. C.

Money statement.

July 1, 1882, amount available	$119 90
Amount appropriated by act passed August 2, 1882	6,000 00
	6,119 90
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	5,947 37
July 1, 1883, amount available	172 53
Amount (estimated) required for completion of existing project	6,520 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	25,000 00

REPORT OF MR. H. HETH, ASSISTANT ENGINEER.

GEORGETOWN, S. C., *June* 25, 1883.

CAPTAIN: I have the honor to submit the following report of work done on the Great Pee Dee River since my last report:

In compliance with your instructions, work was resumed on this river in November last. A working party under a competent overseer was employed, and work begun at or near "Fountain's Landing," trimming the banks of such overhanging trees as interfered with the passage of steamers plying on the river. Similar work was done at Wild's Landing, Williamson's Landing, Nevel's Creek, Hunt's Bluff, Hennigan's Landing, and Buzzard's Bar. This work was very thoroughly done and gives general satisfaction to those interested and competent to judge, namely, the masters of vessels and steamers and the pilots navigating the same.

The steam hoister Samson was hired by your orders and kept at work until February 9, 1883, between the mouth of the Great Pee Dee and Smith's Mills, 47 miles from the mouth of the river, clearing the channel of the river of sunken logs and other obstructions to navigation. The steam hoister was greatly impeded in her work by the continuous high water which prevailed during her employment on this river.

The benefits to commerce resulting from the expenditures thus far made on this river can be correctly measured by the increased distance the steamers plying on this river can ascend *during low stages of water*. Before any work was done the steamers could only ascend *at low water* as high as the "Pockets," a bend in the river filled with snags and sunken trees. The "Pockets," and a half dozen such bends and reaches impassable for boats at low water, have been thoroughly cleaned out, enabling steamers *now* to ascend the river at low water some 50 miles further than before, thus opening up this much of the country to the benefits of navigation. As the obstructions are removed ascending the river similar benefits will be extended to the farmers on, and in reach of, the river.

The Great Pee Dee was examined by Mr. C. W. Foster in February, 1880. Mr. Foster was very much hurried in his examination. His estimate, $25,520, to procure 9 feet of water from the Waccamaw River, where the Pee Dee empties, and Smith's Mills, and 3½ feet at all stages as far as Cheraw, was entirely inadequate. As an instance, I quote from Mr. Foster's report: "Moving 300 snags, at $10, and 600 fallen trees, at $5 each, $6,000."

From *two* of the many bends obstructed by snags and fallen trees, quite this number of snags and fallen trees have been removed, and when it is now known to be a fact that many such bends, similarly obstructed, exist, you will readily see how far short Mr. Foster's estimate of the cost of clearing out this river must be. The following are the bends and reaches in the river which require improvement in order to get the contemplated depth of water, 3½ feet, from its mouth to Cheraw:

Sugar Loaf, snags of fallen trees to be removed	$1,200
Askew Bar, snags of fallen trees to be removed	1,500
Buzzard Bar, snags of fallen trees to be removed	2,000
Hennigan's Falls, snags of fallen trees to be removed	1,200
Snowden's Falls, logs to be removed and jetty built	1,200
Low Bottom, logs to be removed	800
Harman Falls, logs to be removed	800
Whirligig, logs to be removed and jetty to be built	900
Society Hill, logs to be removed and jetty to be built	600
Cheraw Bay, trimming	300
Indian Bay, trimming	300
Fish Bait, trimming	200
Mother Griffins, logs to be removed and jetty built	2,000
Taylor's Falls, rocks to be removed by blasting	3,000
Thompson's Creek, jetty to be built	2,000
From mouth of the river to Smith's Mills, snags to be removed, old wreck to be taken up, and banks trimmed	5,000
	23,000
Add 10 per cent. for contingencies	2,300
	25,300

As nearly as can be ascertained, the following is believed to be the shipments down the Pee Dee River during the past year:

Lumber	feet..	37,000,000
Cotton	bales..	39,000
Naval stores	barrels..	125,000
Shingles		75,000,000

On the up-trips the steamers carry a large amount of corn, bacon, and guano, which is distributed at the different landings as high up as Gardner's Bluff, the head of navigation. There are three steamers that ply between Georgetown and the head of navigation on the Great Pee Dee. In addition to these steamers a line of schooners find employment in carrying off the lumber produced at Smith's Mills.

Respectfully,

H. HETH,
Assistant Engineer.

Capt. JAMES MERCUR,
Corps of Engineers, U. S. A.

K 21.

IMPROVEMENT OF WACCAMAW RIVER, SOUTH CAROLINA.

The river and harbor act of August 2, 1882, appropriated $4,400 for this river, which, taken with the previous appropriations, make up the amount estimated as necessary for completing the improvement.

This original estimate was based upon an examination made under a very small appropriation, which necessitated its being very hurried. The progress of the work has shown many more obstructions than were developed in the examination, and has shown the original estimate to be entirely inadequate for the completion of the work.

Mr. H. Heth, assistant engineer, has had the immediate supervision of the work, and after three years' experience estimates that it will require $25,228 to complete the improvement in a satisfactory manner. This estimate may be considered as reliable as one can be made, but must be understood as liable to modification should further work develop obstructions not now known or discoverable until the shoals are removed.

The strong scour developed by the construction of the jetties at the lower shoals uncovered the foot of some of the sheet-piling used to make them water-tight, rendering some repairs necessary, and a careful study of the action of some of the others indicates that some changes in location are desirable, and that some training-wall should be built joining the jetty heads.

Under the last appropriation work has been carried on in trimming the banks and removing the most troublesome logs and snags between Conwayborough and Cox's Shoal, the party commencing in April last and continuing work to the end of the fiscal year. It is proposed to continue this work and make such repairs to the jetties as the remaining funds will allow.

A copy of the report of Mr. H. Heth, assistant engineer, containing commercial statistics and estimates for completing the improvement of the river, is appended hereto.

Money statement.

July 1, 1882, amount available		$612 03
Amount appropriated by act passed August 2, 1882		4,400 00
		5,012 03
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$2,386 31	
July 1, 1883, outstanding liabilities	348 85	
		2,735 16
July 1, 1883, amount available		2,276 87
Amount that can be profitably expended in fiscal year ending June 30, 1885		2,500 00

REPORT OF MR. H. HETH, ASSISTANT ENGINEER.

GEORGETOWN, S. C., *June* 25, 1883.

CAPTAIN: I have the honor to submit the following report of work done on the Waccamaw River during the past year:

In May, 1882, the available appropriation for the improvement of the Waccamaw being nearly expended, work was suspended and the plant taken to Conwayborough, where it was looked after by Capt. T. W. Daggett, of that village, who also kindly stored in his storehouse the movable property pertaining to this plant. In accordance with your instructions of March 29, 1883, work was resumed on the Waccamaw in April last. The available appropriation being very small, you deemed it best not to hire machinery for jetty work, or to work on the jetties not completed. By your direction a gang of hands was employed under a competent overseer to trim the banks of overhanging trees, which, at the sharp bends of the river, below Conwayborough, greatly interfered with the passage of steamers and vessels plying on the river between Conwayborough and Georgetown. This work is now being pushed ahead, is progressing favorably, and gives entire satisfaction.

In compliance with your instructions I made, in April, a careful personal examination of the system of jetties complete and not completed, at low stages of the river, and submit below an estimate of the amount necessary to complete the jetties and to render them efficient. But two of the contemplated system of jetties for the improvement of the navigation of the Waccamaw River have been brought to an approximate stage of completion, that is, one at "Oat Bed Shoal," the other at the "Needle's Eye Shoal." Sufficient has been proved by the action of the current on the sand bars of the above shoals, caused by the jetties deepening and keeping the channel open to the required depth, 12 feet, high tide, to convince me that like results can be obtained where other bars exist and interfere with the navigation of the river.

The following are the shoals in order, as met with in descending the river from Conwayborough to Winyah Bay, with the present depth of water on each shoal. The project for improving the Waccamaw River contemplates securing a depth of 12 feet, high tide, over the shoals:

Cox Shoal, 7 feet, high tide.
Indian Creek, 8 feet, high tide.
Jackson's Bluff Lake, 9½ feet, high tide.
Dennis' Fish-hole, 9 feet, high tide.
Jackson's Bluff, 10 feet, high tide.
Green's Landing, 11 feet, high tide.
Boat House, 14 feet, high tide, solid jetty completed.
Mount's Landing, 10 feet, high tide.
Needle's Eye, 12 feet, high tide.
Oat Bed, 11½ feet, high tide.

The following estimates have been made, after careful examination, as required to complete the jetties at the several points above mentioned:

Cox Shoal	$5,250
Indian Creek Shoal	550
Jackson's Bluff Lake Shoal	500
Dennis' Fish-hole Shoal	600
Jackson's Bluff Shoal	650
Green's Landing Shoal	500
Boat House Shoal, repairs needed	25
Mount's Landing Shoal, repairs needed	60
Needle's Eye Shoal, to convert into solid jetty	800
Oat Bed Shoal, to convert into solid jetty	1,000
	9,935
Trimming banks and removing logs from river between Cox Shoal and Conwayborough	7,000
	16,935
Trimming banks and removing sunken trees and logs between Cox Shoal and Pot Bluff	6,000
	22,935
Add 10 per cent. for contingencies	2,293
	25,228

In making the above estimate, I have purposely avoided estimating the *number* of sunken logs and trees to be removed from the channel of the river, as well as the cost of removing each log. My experience during the past three years has convinced me

that such estimates are guess-work, as I have found in several bends and reaches filled with logs more logs to be removed than were reported as existing in the entire river. Nor can the cost of removing each log be correctly arrived at or averaged. Some days the hoister would remove twenty or more sunken logs, and, again, would work three days on a single log, which probably would, at last, have to be blown to pieces with powder. The estimate for the above work has been based upon the cost of hiring machinery to do like work.

The advantages derived by commerce from the expenditures already made are easily arrived at. Before any improvement of the river, vessels loading with lumber and naval stores at Buck's Mill and Pot Bluff could load down to 7 *feet only*, had to drop down below Needle's Eye and Oat Bed Shoals, and take on the balance of their cargo from lighters, and even loaded to 7 feet were not infrequently detained on one or both of these shoals for several days at a time. Now vessels load down to 11½ feet, taking on a full cargo, and no instance of detention on either of these shoals has occurred since the jetties have been put down.

The following shipments have been made down the Waccamaw during the past year:

Feet of lumber	25,000,000
Barrels of naval stores	150,000
Tierces of rice	5,000
Bales of cotton	35,000
Shingles	1,500,000

A large and increasing number of schooners ply between the northern ports and Pot Bluff, carrying these products to market. Six steamers are employed more or less of their time on this river.

The Waccamaw River is in the collection district of Georgetown, S. C.

Very respectfully,

H. HETH,
Assistant Engineer.

Capt. JAMES MERCUR,
Corps of Engineers, U. S. A.

K 22.

IMPROVEMENT OF SANTEE RIVER, SOUTH CAROLINA.

The river and harbor act of August 2, 1882, appropriated $20,000 for continuing the improvement of this river.

At the end of the last fiscal year papers granting the right of way to the United States for certain cuts to connect the Santee River with Winyah Bay by way of Mosquito Creek were in the hands of the Department of Justice for examination and approval.

These papers being returned approved, advertisements inviting proposals for dredging and building a draw-bridge were published, and the proposals were opened October 25, 1882.

No bids for dredging were received, and the bids for the bridge were considered too high and were rejected.

Authority was then obtained to do the work by hired labor and purchase of material in open market, but a claim having been made that a title to a portion of the land through which right of way was granted was not good, a delay occurred for investigating this claim.

Pending the decision of this point, authority was granted to make the cut through the land the title to which is undisputed, and the completion of which cut will give communication between the river and bay.

Under this authority a dredge has been hired and the preliminary steps taken for beginning work, which it is supposed, will commence early in July.

This work is in the collection district of Georgetown, S. C.

The appropriations for this work have been:

March 3, 1881	$22,000
August 2, 1882	20,000

Money statement.

July 1, 1882, amount available		$20,627 06
Amount appropriated by act passed August 2, 1882		20,000 00
		40,627 06
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$93 29	
July 1, 1883, outstanding liabilities	327 58	
		420 87
July 1, 1883, amount available		40,206 19
Amount (estimated) required for completion of existing project		62,427 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		40,000 00

K 23.

IMPROVEMENT OF WATEREE RIVER, SOUTH CAROLINA.

The act of August 2, 1882, appropriated $15,000 for the improvement of this river.

Work during the year has been carried on in accordance with an approved project for clearing out the river by hired labor and purchase of material in open market, with a view to ultimately securing a depth of 4 feet at low water.

At the close of the last fiscal year the near exhaustion of funds necessitated a stoppage of work until a new appropriation became available.

After the new appropriation was made, continual high water prevented any work being done until May, 1883, when, the river having fallen to a stage suitable for active operations, a steam-hoister was hired, and worked five days in May and up to the 17th of June, below the bridge of the Camden branch of the South Carolina Railway, completing improvements of the channel from the mouth of the river up to this point.

The hoister then passed under the bridge, made a thorough examination of the river up to Camden, and, returning, worked up to the end of the fiscal year between the bridge of the South Carolina Railway and that of the Wilmington, Columbia and Augusta.

The examination showed the river, between the two bridges, to be filled with a network of logs and trees, and, above the Wilmington, Columbia and Augusta bridge, to be similarly obstructed at a great many points, making it very difficult for the hoister, drawing 1½ feet, to pass up to Camden, this only being accomplished by hauling her over logs by using her machinery.

This examination, which was much more thorough than was practicable by any other means, shows the existence of so many logs, snags, and trees, that it is very probable the complete clearing of the river will cost much more than the original estimates, but how much cannot be definitely stated until the progress of the work develops the exact number and size of the trees. The expense thus far has been, approximately, $1,000 per mile.

The commerce of this river was formerly carried on between Camden and the Wilmington, Columbia and Augusta Railroad Bridge by one steamboat, but this boat having met with several accidents, and not proving remunerative to her owners, she was abandoned and her machinery removed and sold.

The products of the country on the east side of the river reach a market by the South Carolina Railroad. Should the river be cleared out and a steamboat line established, some of the products of the west side of the river might be carried upon it.

There is at present no commerce whatever on the river, so far as can be learned, hence no statistics are furnished.

This work has been under the immediate supervision of Mr. H. Heth, assistant engineer.

The Wateree is in the collection district of Georgetown, S. C.

Money statement.

July 1, 1882, amount available		$149 69
Amount appropriated by act passed August 2, 1882		15,000 00
		15,149 69
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$1,107 71	
July 1, 1883, outstanding liabilities	1,381 60	
		2,489 31
July 1, 1883, amount available		12,660 38
Amount (estimated) required for completion of existing project		31,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		31,000 00

K 24.

IMPROVEMENT OF GEORGETOWN HARBOR, SOUTH CAROLINA.

The river and harbor act of August 2, 1882, appropriated $7,000 for the improvement of this harbor. The only improvement practicable involves considerable dredging, and, for permanence, dikes in addition. The amount appropriated is not sufficient to complete the dredging and build the dikes.

No dredging machinery is owned in or near Georgetown Harbor, except one dredge, recently built and now hired by the United States for work on Santee River.

It being manifestly impracticable to accomplish any result which promises even temporary benefit to navigation, with the amount of money available, no operations have been undertaken, neither is it considered advisable to begin work until such time as more money and suitable machinery are available.

COMMERCIAL STATISTICS.

No commercial statistics of Georgetown have been received, but it is the shipping port of the products brought down the Pee Dee, Waccamaw, Black River, and Lynche's Creek, having two or three lines of schooners running to New York and a line of steamers to Charleston and up the Pee Dee River.

Money statement.

Amount appropriated by act passed August 2, 1882	$7,000 00
July 1, 1883, amount available	7,000 00
Amount (estimated) required for completion of existing project	7,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	25,000 00

APPENDIX L.

IMPROVEMENT OF THE RIVERS AND HARBORS ON THE COAST OF SOUTH CAROLINA, GEORGIA, AND THE ATLANTIC COAST OF FLORIDA.

REPORT OF COLONEL Q. A. GILLMORE, CORPS OF ENGINEERS, BVT. MAJ. GEN., U. S. A., OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1883, *WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

1. Charleston Harbor, South Carolina.
2. Wappoo Cut, South Carolina.
3. Edisto River, South Carolina.
4. Salkiehatchie River, South Carolina.
5. Ashley River, South Carolina.
6. Savannah Harbor and River, Georgia.
7. Savannah River, Georgia.
8. Savannah River above Augusta, Ga.
9. Romley Marsh, Georgia.
10. Brunswick Harbor, Georgia.
11. Altamaha River, Georgia.
12. Entrance to Cumberland Sound, Georgia and Florida.
13. Saint John's River, Florida.
14. Volusia Bar, Florida.
15. Saint Augustine Creek (Thunderbolt River), Georgia.
16. Inside passage between Fernandina and Saint John's River, Florida.
17. Removal of sunken vessels obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
New York, July 30, 1883.

GENERAL: I have the honor to transmit herewith my annual reports upon the works of river and harbor improvement under my charge for the fiscal year ending June 30, 1883.

Very respectfully, your obedient servant,

Q. A. GILLMORE,
Colonel of Engineers,
Bvt. Maj. Gen., U. S. A.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

L 1.

IMPROVEMENT OF THE HARBOR AT CHARLESTON (INCLUDING SULLIVAN'S ISLAND), SOUTH CAROLINA.

During the fiscal year ending June 30, 1883, operations for improving the entrance into Charleston Harbor, S. C., were carried on in conformity to the plan submitted in my communication to the Chief of Engineers, dated March 9, 1878, and printed as Appendix H of the Annual Report of the Chief of Engineers, 1878.

By this project it is designed to establish and maintain, by means of two low jetties, a low-water channel of not less than 21 feet depth across

the bar, upon which the greatest available depth has heretofore been only 11½ feet. The estimated cost of the project was $1,800,000.

Previous to the spring of 1878 there had been expended by the General Government in the improvement of the ship channels in Charleston Harbor subsequent to the close of the civil war (from 1871 to 1878) the sum of $93,700 in taking up the wrecks of fourteen iron-clad and wooden vessels sunk during the war, and in removing a portion of the Bowman Jetty projecting into Beach Channel.

RECAPITULATION OF OPERATIONS PREVIOUS TO JUNE 30, 1882.

North jetty.—The work of constructing this jetty was commenced in December, 1878. On June 30, 1882, the seaward end of the bottom course of the work was at a distance of 14,361 feet from the starting point on the shore of Sullivan's Island, measured along the axis of the work.

The widths of this bottom course varied from 43 feet at the shore, to 118 feet at the sea end, and in height from 2½ to 4 feet. A second course of mattresses, varying from 66 feet to 81 feet in width, was laid over the bottom course for a length of 1,648 feet from a point about 7,600 feet from Sullivan's Island seaward; the height of this portion of the jetty being thereby increased to 5½ or 6 feet. The gap formerly left on Drunken Dick Shoal was closed by a foundation course of 1,663 feet in length, 64 feet in width, and 3¾ to 4 feet in height. South of that shoal the jetty was raised by distributing riprap stone over it. In some places the height thus attained was from 13 to 14 feet from the bottom.

Up to June 30, 1882, the aggregate amount of riprap stone placed upon this jetty was 93,902 cubic yards. The mattress work, of an average thickness of 18 inches, composed of logs and brush, amounted to 144,077 square yards.

South jetty.—This work was begun in April, 1880. On June 30, 1882, the seaward end of the foundation course had reached a distance of 10,122 feet from the shore of Morris Island, measured along the axis of the work, and about 1½ miles within the outer 18-foot curve of the bar.

On June 30, 1882, the bottom course of the south jetty had not only crossed the main ship-channel, where the greatest depth was 39 feet at mean low water, but also the comparatively deep pocket to the east of it, with low-water depths of from 18 to 25 feet. When work closed, the seaward end of the jetty rested in about 16 feet low-water depths on the inner slope of the bar.

To a point about 8,660 feet from its shore end the jetty had been laid upon a straight course, bearing south 87 degrees east. In continuing the work from that point seaward the direction was changed, and the axis of the work was laid on chords of about 400 feet length, of a circular arc struck with a radius of 1⅞ statute miles, approximately, with the intention of maintaining this curved line of axis until a point should be reached 2,900 feet from the straight, seaward portion of the north jetty. From that point it is proposed to run the south jetty on a straight course, parallel to the north jetty, to its final seaward terminus.

Strong currents had been observed, toward the latter part of 1881, to set across the bottom course of the jetty, near its easterly or seaward end. The width of the mattresses was here uniformly 108 feet. It was deemed advisable to guard against the danger of scour or undercutting by introducing, at intervals, mattresses of 130 feet width, the largest width found to be practicable, which projected from 6 to 15 feet beyond the other mattresses on either side. The projecting portions were de-

signed to act as short spurs. This system of spurs was commenced from a point 7,500 feet from the shore end. The spaces between spurs averaged 70 feet.

Some change in the mode of laying the mattresses was made during the fiscal year ending June 30, 1882, by allowing each mattress of the bottom course to lap from 10 to 20 feet on the mattress previously laid. Spaces between mattresses and loss of stone were thus prevented, and some additional height gained. This mode of laying mattresses was commenced and continued from a point about 8,500 feet from the shore end.

Up to June 30, 1882, the aggregate amount of riprap stone placed upon the south jetty, from the beginning of operations, was 38,164 cubic yards, and the quantity of mattresses averaging 18 inches in thickness sunk during the same time, amounted to 97,894 square yards.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1883.

During the past fiscal year operations were carried on by means of the appropriation of $300,000 made by act of Congress passed August 2, 1882.

The work done consisted essentially in further extending the bottom course of the south jetty, in sinking a second course of mattresses upon the foundation course of the jetty across the deepest portion of the present main ship channel, and across the deep pocket east of that channel, and in enlarging the foundation course of the work where it crosses the main ship channel, by placing an additional apron mattress to the south of and adjoining it.

No work was done on the north jetty.

A general survey of the outer harbor, including the bar and its exterior slope, was commenced.

All the work on the south jetty, and on the spur on Sullivan's Island, done during the fiscal year just closed, was performed under the contract entered into with Mr. A. A. Howlett, dated September 30, 1882.

He was the lowest bidder at the second call for proposals of September 2, 1882, all the bids received under a first call, dated August 12, 1882, having been rejected by authority of the Chief of Engineers.

Under the contract made with Mr. Howlett, he is paid 72 cents per square yard for mattresses, and $3.59 per cubic yard for riprap stone, weighing not less than 2,800 pounds per cubic yard. The mattresses are constructed, substantially, in the same manner as under the previous contract entered into on June 11, 1881, with Mr. E. T. Bangs, referred to in my annual report of 1881.

By the terms of the contract, the work to be done under it was to be completed on July 20, 1883. Unavoidable delay, caused by fogs and stormy weather prevailing to a great extent during last winter, compelled the contractor to ask for an extension of time to November 15, 1883. The request was granted, with the approval of the Chief of Engineers.

South jetty.—The apron foundation of this work was continued as begun in March, 1882, by directing its axis on chords 400 feet long of a circular arc of about $1\frac{7}{8}$ statute miles radius.

When work was resumed in October, 1882, it appeared to be expedient to make a change in the disposition of spurs, or rather of their bottom courses, introduced in December, 1881, in order to render them more effective in protecting the jetty from the scouring currents. While continuing the work of extending the first or bottom course of the jetty,

by laying mattresses of 108 feet width, the foundation mattresses of spurs were laid, about 200 feet apart, center to center, on both sides of the work and opposite to each other, each mattress measuring 50 feet by 100 feet.

Every mattress lapped a few feet on the central foundation mattress, and therefore projected by nearly its whole length of 100 feet, north or south, beyond the edge of the central course. The logs of these long spur foundations are parallel to the axis of the jetty, so that they may sink separately, with their load of brush and stone on them, into the holes that may be scoured underneath them by the current.

From January to April, 1883, a second course of mattresses from 40 to 50 feet in width was placed upon the bottom course of the south jetty where the same crosses the existing main ship-channel, and beginning at a point 4,805 feet from the shore of Morris Island. This second course was extended to a length of 1,554 feet through the deepest part of the main ship-channel to the shoaler water east of it.

The original widths of the bottom course on this portion of the work ranged from 60 to 112 feet. As a precautionary measure, and because this course would eventually have to be widened to form a sufficient base for the jetty when finished to its ultimate height, additional foundation mats were sunk, simultaneously with those of the second course, on the south side of the original bottom course, lapping the same a few feet. The additional apron thus far laid begins and ends about opposite to the two terminal points of the second course referred to, a length of about 1,570 feet. The mattresses vary from 60 to 100 feet in width. During the time these operations were carried on, long continued rough weather prevented any work being done in extending the jetty seaward.

During the past fiscal year the foundation course of the south jetty was extended 2,657.7 feet. The seaward end of the work is now 12,779.7 feet, or about 2.4 miles from the shore of Morris Island, measured along the axis of the jetty, and about 1 mile within the outer 18-foot curve of the bar.

The width of mats used in extending the jetty was uniformly 108 feet. Nine sets or pairs of long spurs are distributed along the extension. Where these spurs are located the aggregate width of the bottom course of the extension is correspondingly enlarged, and amounts to from 295 to 312 feet. All these mattresses are covered with riprap stone to an average thickness of 12 inches.

The mattresses of the second course received about 16 inches thickness of stone; those of the additional apron across the main ship-channel about 18 inches.

The log and brush mattresses, averaging 18 inches in thickness, laid during the year, aggregated 80,299 square yards. During the same period 35,753 cubic yards of riprap stone were distributed on the work.

The total quantity of mattress work employed in constructing the south jetty from the beginning of the work to the end of the fiscal year just closed is 178,193 square yards, and an aggregate amount of 73,917 cubic yards of rip-rap stone has been deposited on it during the same period.

Spur jetties, Sullivan's Island.—Nothing was done during the past fiscal year for protecting the seaward shore of Sullivan's Island. A contract is about being made for putting 250 cubic yards more or less of riprap stone upon a bare place of the second spur jetty, located about 3,100 feet east of Fort Moultrie. This jetty was built in December, 1880, under a special appropriation made by Congress. A report of the work is printed as Appendix J 2 of the Annual Report of the Chief of Engineers for 1881.

CONDITION OF THE WORK AND OF THE OUTER HARBOR.

An extensive survey of the outer harbor and bar is now in progress, the results of which will show their present condition and the changes caused by the works of improvement.

A skilled diver has been employed since June last for the purpose of thoroughly examining both jetties and the sea bottom in their vicinity. These investigations had not been brought to a close at the date of this report.

At the beginning of the year 1883 it was found that the deep-water area between Fort Moultrie, on Sullivan's Island, and the north end of Morris Island had materially enlarged, and its 18-foot curve had farther extended toward Swash Channel in a long pocket. The deep-water basin just south of that pocket had much increased in area.

The shoal between the main ship-channel and the entrance to Swash Channel had diminished in area, and had a greater depth of water upon it than formerly.

The extensive shoal in advance of the south jetty has been considerably cut away and forced seaward.

Constant changes were going on in Swash Channel, owing to the irregularity of the sand movement to the sea.

It is not doubted that a great part of these changes is due to the works thus far constructed.

OPERATIONS CONTEMPLATED DURING THE FISCAL YEAR ENDING JUNE 30, 1884.

During the fiscal year beginning July 1, 1883, operations will be carried on by means of the balance on hand on that day, amounting to $99,468.01.

With these funds the work will be continued in accordance with the existing project, chiefly in raising the south jetty to a greater height at some low places, and in extending its foundation course farther seaward. A small portion of the funds may perhaps be used in constructing some protective works on the seaward shore of Morris Island. The general survey of the outer harbor and bar will be completed.

NECESSITY OF FURTHER APPROPRIATION.

I must again refer to the necessity of having liberal appropriations made for carrying on this improvement.

The remark made in my annual report of last year that the work had arrived at a critical period may be now repeated with still greater emphasis. The changes going on in Swash Channel and at other places previously noticed are indications that the formation of the new channel is in progress. But after exhausting the funds now available the jetties will have neither sufficient length nor height to produce decisive effects. They will probably continue for some time to cause a greater volume of water than formerly to pass through Swash Channel, increasing its depth here and there in an irregular manner, but the formation of a permanent channel available for navigation will not be secured.

A real danger to the shipping interests of Charleston is liable to result from a suspension of operations. The greater flow of water through Swash Channel diminishes the volume of water passing through Pumpkin Hill Channel, which is now used by larger vessels; it has been reported that there is now less depth of water in that channel than formerly. It would be a matter of deep regret if this deterioration should become serious, without being able to secure, in advance, a compensation by rapidly increasing the efficiency of the new bar channel between the jetties.

An early resumption and vigorous prosecution of operations, including a considerable amount of dredging in Swash Channel, is therefore of urgent importance.

A special appropriation of not less than $80,000, to be made available during the next winter is earnestly recommended.

In my annual report for the fiscal year ending June 30, 1881, I offered some remarks concerning the amount of commerce and navigation that will be benefited by completing the existing project of improvement. No additional data of value have since been obtained. Moreover, the improvement of the entrance to Charleston Harbor has been already recognized as a work of national importance, through the several appropriations made for it by Congress since 1878.

This work is located in the collection district of Charleston, S. C., at the port of entry. Amount of duties collected in 1882, $45,268.33.

In my annual report of last year I stated that the original estimate is considered sufficient if the work can be completed within about the next two years. In my annual report of 1878, which contains the project for improving Charleston Harbor, since adopted, I said that it would be very desirable that the annual appropriations should be about one-fourth the entire amount of the total estimate of $1,800,000 for four successive years, and that the completion of the work in three years would accomplish a considerable saving in the aggregate cost. It is now over four and one-half years since the work was commenced; the appropriations thus far made for it aggregate $1,045,000, leaving a balance of $755,000 still to be provided for. Whether the amount of the original estimate will be sufficient, furnished intermittently in small sums, to establish an improved and permanent ship-channel on the bar as contemplated in the original project, is extremely doubtful. When the results of the survey of the outer harbor, now in progress, become known, it may be found necessary to increase the estimates. If so, a special report will be submitted.

Since the present plan of improvement was adopted, the following appropriations have been made:

By act of Congress approved June 18, 1878	$200,000
By act of Congress approved March 3, 1879	200,000
By act of Congress approved June 14, 1880	170,000
By act of Congress approved March 3, 1881	175,000
By act of Congress passed August 2, 1882	300,000
Total	1,045,000

Of this amount there has been expended, from the beginning of operations to June 30, 1883, the sum of $945,531.99, including outstanding liabilities.

The following drawings and papers accompany this report:

Sheet 1. Chart showing the sites of the two jetties and latest soundings.

Sheet 2. Showing longitudinal section and diagram of widths of south jetty at close of fiscal year.

Report of Lieut. T. N. Bailey, Corps of Engineers.

A table of commercial statistics furnished by the collector of the port.

Money statement.

Amount appropriated by act passed August 2, 1882		$300,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$163,654 77	
July 1, 1883, outstanding liabilities	36,877 22	
		200,531 99
July 1, 1883, amount available		99,468 01
Amount (estimated) required for completion of existing project		755,000
Amount that can be profitably expended in fiscal year ending June 30, 1885		755,000

CHARLESTON HARBOR IMPROVEMENT

SHEET 1.

showing the sites of the North and South Jetties, the progress made in their construction to June 30, 1883, and the present depths on the bar.

Under the direction of

COL. Q. A. GILLMORE, Corps of Engrs, Bvt. Maj. Gen. U.S.A.

1ST LT. T.N. BAILEY, Corps of Engrs in local charge.

JAMES P. ALLEN, Asst. Engr.

Accompanying annual report, dated July 30 1883, for fiscal year ending June 30, 1883.

D. A. Gillmore
Col. Engrs. Bvt. Maj. Genl. U.S.A.

SCALE OF FEET.

1000 500 0 1000 2000 3000 4000

FT. MOULTRIE

SULLIVAN'S ISLAND

High water line

Low water line

FT. SUMTER

TRUE MERIDIAN

NORTH JETTY

SOUTH JETTY

MORRIS ISLAND

High water line

Low water line

Note.

The soundings taken May 1883, are in feet and tenths and are reduced to mean low water.

The 18 ft. curve is indicated thus: ... ...

" 15 ft. " " " ——— ———

" 12 ft. " " " ... ...

Work executed during the last fiscal year is indicated thus: ═══

Previous work is indicated thus: ═══

CHARLESTON HARBOR IMPROVEMENT

SHEET 2

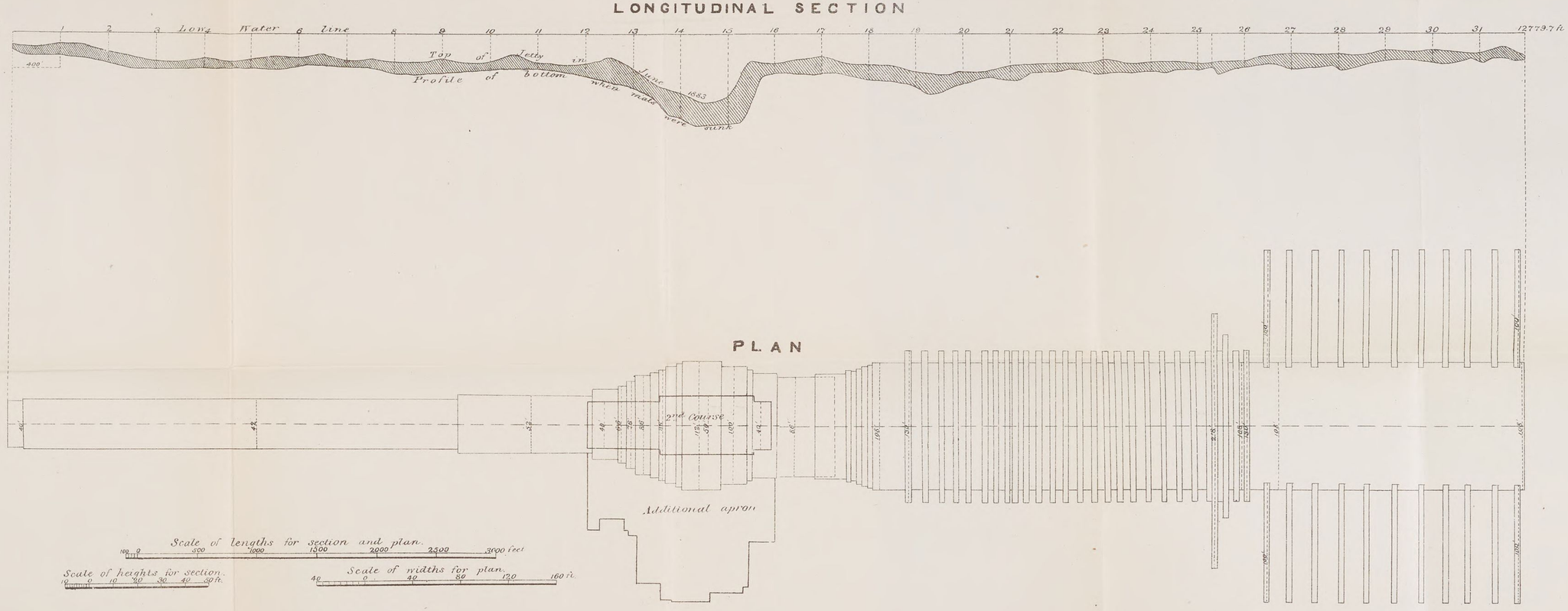
Showing section of the South Jetty, and a plan of the mattress at various points as built to June 30, 1883.

Accompanying annual report, dated July 30, 1883, for fiscal year ending June 30, 1883.

D. A. Gillmore
Col: Engrs Bvt. Maj. Gen. U.S.A.

MORRIS ID.

LONGITUDINAL SECTION



Abstract of proposals for construction of jetties in Charleston Harbor, South Carolina, opened September 18, 1882.

No.	Names and addresses of bidders.	Mattresses.	Riprap stone.
		Per sq. yd.	*Per cu. yd.*
1	A. Ames Howlett, Syracuse, N. Y	$0 72	$3 59
2	Newton and Eckstein, New York, N. Y	0 77	3 60

Contract awarded A. Ames Howlett, dated September 30, 1882; to commence October 16, to complete July 20, 1883.

REPORT OF LIEUTENANT THOMAS N. BAILEY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., July 23, 1883.

COLONEL: I have the honor to submit the following report of operations during the past fiscal year for "improving harbor at Charleston, S. C." The work has been confined to the south jetty.

The foundation course has been extended from a point 10,122 feet from the shore end to a point 12,779.7 feet distant; total advance, 2,657.7 feet. The mattresses of this extension are 108 feet wide, and were loaded with from 13 to 16 inches of stone.

Spurs 100 x 50 feet, carrying 18 inches of stone, were placed on both sides of the extension 220 feet apart.

An apron course, 1,569.4 feet long, was placed on the south side of the jetty, outward from a point 4,805 feet from Morris Island.

The apron mats were 60 or 100 feet wide, and received 12 to 18 inches of stone. A second course of mats was placed between points 4,805 and 6,358.9 feet distant from the shore end; total length, 1,553.9 feet.

These mats were 40 and 50 feet wide, and were loaded with from 12 to 16 inches of stone.

Table of work done.

Course.	Number of mats placed.				Mats.	Stone.
	First.	Spurs.	Second.	Apron.		
					Square yards.	*Cubic yards.*
October, 1882	15	.....	.....	.....	9, 356. 33	3, 753. 39
November, 1882	10	5	.....	.....	8, 819. 77	2, 561. 04
December, 1882	8	3	.....	.....	6, 478. 65	3, 457. 34
January, 1883	4	2	7	7	7, 271. 33	5, 074. 30
February, 1883	.....	.....	8	10	6, 736. 67	4, 092. 33
March, 1883	.....	.....	10	16	11, 744. 35	5, 656. 40
April, 1883	5	2	11	6	9, 452. 35	3, 333. 92
May, 1883	15	6	.....	.....	12, 362. 86	3, 975. 45
June, 1883	10	4	.....	.....	8, 076. 69	3 849. 11
Total	67	22	36	39	80, 299. 00	35, 753. 28

Accompanying this report are—
Sheet I. Plan of jetties, progress &c.
Sheet II. Section of south jetty, &c.
Mr. J. P. Allen, assistant engineer, has performed his duties with skill and fidelity

Very respectfully, your obedient servant,

THOS. N. BAILEY,
First Lieut., Corps of Engineers.

Col. Q. A. GILLMORE,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels at Charleston, S. C., from January 1, 1875, *to December* 31, 1882.

VESSELS ARRIVED.

Year.	Coastwise.			American vessels from foreign ports.			Foreign vessels from foreign ports.			Total.		
	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.
1875	504	382, 018	11, 649	38	13, 144	326	198	88, 879	2, 404	740	484, 041	14, 379
1876	471	340, 439	10, 113	44	11, 898	335	224	101, 272	2, 768	739	453, 609	13, 216
1877	400	324, 919	9, 885	32	13, 972	308	236	105, 480	2, 851	668	444, 371	13, 044
1878	399	322, 527	9, 623	44	19, 935	455	329	163, 368	3, 967	772	505, 830	14, 045
1879	383	326, 681	10, 027	39	12, 505	319	246	121, 503	3, 292	668	460, 689	13, 638
1880	441	388, 026	10, 641	38	12, 412	327	191	110, 771	2, 595	670	511, 209	13, 563
1881	412	399, 732	10, 377	34	9, 430	272	257	121, 077	3, 073	703	530, 239	13, 722
1882	410	384, 690	9, 446	35	4, 807	224	200	105, 647	2, 648	645	495, 144	12, 318

VESSELS CLEARED.

Year.	Coastwise.			American vessels for foreign ports.			Foreign vessels for foreign ports.			Total.		
1875	461	328, 266	10, 830	57	24, 679	555	211	94, 595	2, 527	729	447, 540	13, 912
1876	431	278, 744	9, 095	60	23, 598	546	230	103, 276	2, 812	721	405, 618	12, 453
1877	335	234, 429	7, 719	35	22, 767	423	250	108, 446	2, 910	620	365, 662	11, 052
1878	266	172, 988	5, 801	45	24, 397	479	398	149, 975	3, 591	509	347, 360	14, 045
1879	287	188, 212	6, 268	34	11, 282	292	278	149, 052	3, 643	599	348, 546	10, 203
1880	296	190, 733	6, 348	45	23, 210	481	246	155, 768	3, 375	587	369, 711	10, 204
1881	268	187, 569	5, 942	32	9, 239	255	278	153, 796	3, 464	578	350, 604	9, 661
1882	147	113, 699	3, 690	40	7, 375	273	263	158, 250	3, 584	450	379, 324	7, 547

Year.	Value of exports.	Value of imports.	Duties collected.
1875	$19, 655, 966	$680, 343	$80, 656 00
1876	18, 088, 152	455, 562	89, 168 00
1877	16, 917, 492	161, 237	46, 848 00
1878	21, 167, 575	184, 127	36, 990 00
1879	18, 693, 126	127, 981	24, 070 00
1880	24, 939, 259	248, 158	46, 453 98
1881	21, 927, 269	713, 049	99, 066 23
1882	19, 907, 099	459, 970	45, 263 33

T. B. JOHNSTON,
Collector.

SPECIAL REPORTS.

UNITED STATES ENGINEER OFFICE,
New York, December 27, 1882.

GENERAL: I have the honor to acknowledge the receipt of letter from office of the Chief of Engineers, dated 18th instant, inclosing a copy of the resolution of the Senate of the United States of December 13, 1882, and directing an early report thereon.

The resolution is as follows:

Resolved, That the Secretary of War be directed to furnish the Senate with such information as he may have in his possession, or may be able to obtain, as to the condition and progress of the work of the improvement of Charleston Harbor; and also if the money appropriated by the act of August second, eighteen hundred and eighty-two, is now being expended, and at what rate, and what balance may probably remain from that appropriation unexpended at the expiration of the present fiscal year.

I have the honor to report that since December, 1878, operations for improving the entrance into Charleston Harbor, South Carolina, have been carried on in accordance with the plan submitted by Lieut. Col. Q. A. Gillmore, Corps of Engineers, U. S. A., in his communication to the Chief of Engineers dated March 9, 1878, and printed in Appendix H of the Annual Report of the Chief of Engineers for 1878.

By this project it is designed to establish and maintain by two jetties a low-water channel of not less than 21 feet depth across the bar, upon which the greatest available depth has heretofore been only 11½ feet.

The estimated cost of the project is $1,800,000.

The jetties are named the north jetty and south jetty, respectively. The north jetty has its shore end on Sullivan's Island; the south jetty, on Morris Island.

The seaward end of the foundation course of the north jetty has now reached a point 14,361 feet distant from the shore of Sullivan's Island, measured along the axis of the work, and about 1,000 feet inside the 18-foot curve of low-water depths on the outer slope of the bar.

The crest of the work rises from 2½ to 4 feet above the original bottom. The total amount of riprap stone thus far placed on the north jetty is 93,902 cubic yards. This stone rests upon log and brush mattresses, about 18 inches in thickness, aggregating 144,077 square yards.

On November 30, 1882, the seaward end of the apron of the south jetty was 11,024 feet from the shore of Morris Island, measured along the axis of the work, and about 1½ miles from the outer 18-foot curve of low water of the bar.

The aggregate height of the work varies from 3 to 6 feet.

Since the beginning of operations on the south jetty, and up to November 30, 1882, the entire amount of material used upon this work was 44,478 cubic yards of riprap stone, and 116,070 square yards of log and brush mattresses, averaging 18 inches in thickness.

The work as far as constructed is generally in a satisfactory condition, notwithstanding some slight settlement has occurred at different periods at several portions of both jetties. Thus far nothing of a serious nature has taken place. At other points sand is collecting over the work, aiding in protecting the mattress logs from the attacks of the teredo.

Considerable scour has recently been observed alongside of and past the seaward portion of the south jetty. This has not only necessitated the construction of spur jetties on either side of it, but also indicates the expediency of a rapid seaward extension of the work, to guard against an undue increase of its ultimate cost.

To expend the sum of $300,000 appropriated for improving the entrance to Charleston Harbor, by act of Congress passed August 2, 1882, a contract was entered into, on September 30, 1882, with Mr. A. Ames Howlett, of Syracuse, N. Y., who agreed to do at least $25,000 worth of work per month.

Operations under this contract were commenced during the latter part of October last, and are now progressing. It is calculated that of said appropriation not more than $50,000 will remain unexpended at the end of the present fiscal year, and it is probable that the entire sum will be expended by the first of the following August.

It should be stated that, while the future ship-channel proposed to be developed and protected by the jetties is not yet formed nor available for the passage of large vessels, though some important changes are taking place, the existing or Pumpkin Hill Channel shows unmistakable signs of deterioration, caused no doubt by the influence of the works

now in progress. A further reduction of the depths of this channel may be reasonably expected. It seems, therefore, to be of great importance, if not of urgent necessity, to promote the formation of the new ship-channel, not only by pushing out and raising both jetties as rapidly as possible, but also to hasten this effect by dredging, so that increased depths may be obtained at an early date. The increase gained in this manner will undoubtedly be substantially maintained by the jetties if the latter are simultaneously extended and strengthened.

The present appropriation is not sufficient to carry the work through this critical stage, and it is therefore greatly to be desired that an additional sum be made available for the coming fiscal year in order to prevent a suspension of operations.

Should this latter take place, it would undoubtedly cause a very material increase in the cost of this work, and seriously jeopardize even the present inadequate facilities for commerce. As was stated in the last annual report of Lieut. Col. Q. A. Gillmore, Corps of Engineers, $755,000 can be profitably expended during the fiscal year ending June 30, 1884.

Very respectfully, your obedient servant,

JAS. C. POST,
Captain of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., March 1, 1883.

SIR: I have the honor to return herewith the resolution of the Senate of the United States of February 27, 1883, directing the Secretary of War—

to furnish the Senate with any information, recently received, he may have in regard to the condition and progress of the work for the improvement of Charleston Harbor, in addition to that transmitted with his letter of January 3, 1883, in response to the Senate resolution of December 13, 1882—

and to submit in reply thereto the inclosed copy of a letter of the 28th ultimo, from Capt. James C. Post, Corps of Engineers, the officer in charge of the improvement of Charleston Harbor, which, it is believed, will furnish the information desired.

I fully concur in the views expressed by Captain Post of the desirability of an adequate appropriation for this work in the interests of commerce and navigation as well as in that of economy of construction.

Very respectfully, your obedient servant,

H. G. WRIGHT,
Chief of Engineers,
Brig. and Bvt. Maj. Gen.

Hon. ROBERT T. LINCOLN,
Secretary of War.

REPORT OF CAPTAIN JAMES C. POST, CORPS OF ENGINEERS.

WASHINGTON, D. C., *February* 28, 1883.

GENERAL: I have the honor to acknowledge the receipt of the Senate resolution of the 27th instant, referred to me for report.

Since the report which I submitted on December 27, in reply to the Senate resolution of December 13, 1882, the operations for the improvement of Charleston Harbor have been continued as rapidly as possible. Owing to the prevalence of rough weather, which rendered the extension of the foundation course of the south jetty slow and difficult, it has been suspended, and a second course is now being laid to raise and strengthen this work.

Among the effects recently observed, Lieutenant Bailey, Corps of Engineers, in immediate supervision of the improvement, states, in a report just received, that—

> The deep-water area between Fort Moultrie and Cummings Point has materially enlarged; its 18-foot curve has developed toward the Swash Channel in a long pocket. There is a very marked increase in the size of the deep-water basin just south of the pocket.
>
> The shoal between the head of the North and Swash channels has been partly removed. The shoal separating the main ship-channel and the entrance to the Swash Channel has diminished in area and carries more water. The extensive shoal (Sworb Reef) just in advance of the present end of the south jetty has been very considerably cut away and forced seaward. The shoal Jim Evans, north of this, shows similar indications.
>
> The preliminary pressure brought to bear upon the Swash Channel is plainly indicated by a comparatively rapid formation and disappearance of lumps, its tortuous and changeable course, and general irregularity of the sand movement to the sea.

At the present stage of the work the changes noted are all that could have reasonably been expected, and they indicate clearly that if advantage is taken of the present movement of the sand, and this effect continued, a new channel can be expeditiously and economically formed that will satisfy all the requirements of commerce.

With the work already done, and that to be done with the remainder of the present appropriation, which will be expended by August next, it is not expected that this can be accomplished, though many more changes similar in character will take place incident to the partial concentration of the currents. This confining of the waters also diminishes the flow through the channel now in use, and its depth will, without doubt, materially decrease as the work advances. Already reports that there is a less depth in this channel across the bar are being received, and there seems to be great danger that unless all delays are avoided in the prosecution of the work, and it is pushed vigorously forward to completion, even the present inadequate depth in the old channel cannot be obtained in the new one before a decided diminution takes place in the former. Should this occur, a serious effect may be expected upon the commerce of Charleston. It is to this emergency, wherein the present draught of water is endangered, that especial attention is invited at this time.

During the coming year, if a sufficient appropriation is made, it is expected that additional depth will be obtained at once by dredging. This plan requires that the amount be large enough to permit the construction of the jetties to be rapidly advanced while the dredging is being done, in order that the depth gained may be made permanent.

If no appropriation is made by the present session of Congress, a suspension of operations for a year will result, with its hazardous effects upon commerce, and a great increase in the ultimate cost of the work. An insufficient appropriation will probably do but little more than prevent deleterious action upon the portions already constructed.

Seven hundred and fifty-five thousand dollars is the amount reported that can be profitably expended during the next fiscal year. The amount ($100,000) in the bill now under discussion is wholly inadequate for the operations proposed, and it will probably take that entire sum to supply a suitable dredging plant, if the Government is required to build one. It is to be hoped, therefore, that Congress may at this time be so impressed with the importance and urgent necessities of this work, which not only affects Charleston, but all its connections, both north and west, that it will appropriate a sufficient amount to enable the work to be pressed forward without delay, and thus avoid the consequences which are likely to ensue from any other policy.

Very respectfully, your obedient servant,

JAS. C. POST,
Captain of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers.

L 2.

IMPROVEMENT OF WAPPOO CUT, SOUTH CAROLINA.

By the river and harbor act passed August 2, 1882, the sum of $10,000 was appropriated for improving Wappoo Cut, South Carolina. An equal amount had previously been appropriated by act approved March 3, 1881, which was the first appropriation ever made by Congress for this work.

Wappoo Cut is a narrow, tortuous tidal creek, to the north of James Island, South Carolina, connecting Stono and Ashley rivers. An examination with a view to its improvement was made in October, 1880, in compliance with section 2 of the act approved June 14, 1880. My report on this examination, with project of improvement, forms part of Appendix J 4, Annual Report of the Chief of Engineers for 1881, and is printed in House Ex. Doc. No. 19, Forty-sixth Congress, third session.

The project of improvement recommended contemplated the establishment of a straighter channel, of 6 feet depth and 90 feet width at mean low water. The plan comprises the following details of work:

1. Dredging on the bar at entrance into Ashley River.
2. A solid cut through the marsh at the end of the first easterly reach, 2½ miles from Ashley River.
3. Dredging in Elliott's Cut, as well as in the reach leading to it, and on the bar at the outlet into Stono River.
4. Closing the three tidal streams that enter this new direct route from the north by light bulkheads.
5. Building a jetty at the Ashley Entrance to guide the flood tide into Wappoo Cut; and
6. Building a jetty at the Stono Entrance to guide the ebb tide into the cut.

The aggregate cost of these works is estimated at $34,000.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1883.

During the past fiscal year operations were carried on by means of the two appropriations for Wappoo Cut, made in 1881 and 1882, and aggregating $20,000.

It was decided to expend this sum in dredging, beginning at the

Western or Stono River end of the cut. Proposals for dredging were invited on August 25, 1882. Only one firm, the Charleston Dredging Company, responded to the call. It offered to remove the material, per cubic yard, to a distance not exceeding 1 mile, for 16 cents; to a distance not exceeding 2 miles, for 18 cents; and to a distance not exceeding 3 miles, for 20 cents. These prices were deemed reasonable, and with the approval of the Department a contract was concluded on October 21, 1882, with the Charleston Dredging Company. Under the terms of this contract the work was to be completed at the end of the fiscal year. At the request of the company the Chief of Engineers granted an extension of time to August 1, 1883.

From November, 1882, when operations commenced, to June 30, 1883, the material removed by dredging amounted to 91,210 cubic yards.

The channel in Elliott's Cut was improved through its entire length to a low-water depth of 6 feet on a width of 60 feet.

The solid cut mentioned (sub. 2) in the details of the project was carried through, with a low-water depth of 6 feet and an average width of about 80 feet. A similar depth was established on a width of about 50 feet through the shallow reach connecting the two places just mentioned.

On the route thus far improved the depth was formerly but 2½ feet at the shoalest places. The distance by water from Ashley River to Stono River has been reduced from 5.5 miles to 3.6 miles.

CONDITION AND EFFECTS OF THE WORK.

The depths gained by dredging in Wappoo Cut during the past fiscal year have generally been maintained thus far. It is questionable, however, whether they will so continue for a considerable length of time, when operations shall have been suspended for want of funds.

The full width contemplated has not yet been attained on any part of the improved line, and the new banks formed may be expected to cave in here and there and reduce the depths gained. This is especially to be apprehended at the comparatively deep, solid cut through the marsh, although it is hoped that the traffic that will pass through the new channels will aid in keeping them open until operations can be resumed.

An early appropriation, sufficient to complete the project, is undoubtedly desirable. The cuts now made should not only be enlarged, but the other works forming part of the plan should be undertaken as soon as possible. Not before the project is carried out in all its parts can the improvement be considered as being so far completed as to promise a reasonable degree of permanency.

The deterioration of the work thus far done during a long interval of idleness, will certainly cause an increase of the ultimate cost of the improvement and commerce and navigation will so much longer be debarred from enjoying the prospective benefits of the enterprise.

OPERATIONS CONTEMPLATED DURING THE PRESENT FISCAL YEAR.

During the fiscal year beginning July 1, 1883, operations will be continued by means of the balance on hand on that day, amounting to $3,295.20.

The cuts already made will be enlarged and improved as far as the available funds will permit. These will probably be exhausted on or before the 1st of August, 1883.

Since the approval of the project for this improvement the following appropriations have been made:

By act of Congress, approved March 3, 1881	$10,000 00
By act of Congress, passed August 2, 1882	10,000 00
	20,000 00

Of this amount, there had been expended up to the close of the fiscal year ending June 30, 1883, including outstanding liabilities, the sum of $16,704.80.

I have no further statements to add to those made in my previous annual reports regarding the amount of commerce and navigation that would be benefited by completing the improvement of Wappoo Cut.

This work is located in the collection district of Charleston, S. C. Charleston is the nearest port of entry.

Amount of duties collected on imports in 1882, $45,268.33.

The report of Lieut. T. N. Bailey, Corps of Engineers, is transmitted herewith.

Money statement.

July 1, 1882, amount available		$10,000 00
Amount appropriated by act passed August 2, 1882		10,000 00
		20,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$11,432 80	
July 1, 1883, outstanding liabilities	5,272 00	
		16,704 80
July 1, 1883, amount available		3,295 20
Amount (estimated) required for completion of existing project		14,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		14,000 00

Abstract of proposals for dredging in Wappoo Cut, South Carolina, opened September 25, 1882.

No.	Name of bidder.	For material removed, not exceeding 1 mile.	For material removed more than 1 and not exceeding 2 miles.	For material removed more than 2 and not exceeding 3 miles.	Date of commencement.	Date of completion.
		Per cu. yd.	*Per cu. yd.*	*Per cu. yd.*		
1	Charleston Dredging Company.	$0 16	$0 18	$0 20	Nov. 1, 1882	July 1, 1883

Contract awarded at the prices stated.

REPORT OF LIEUTENANT THOMAS N. BAILEY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., July 17, 1883.

COLONEL: I have the honor to submit the following report of operations during the past fiscal year for "improving Wappoo Cut, South Carolina."

The work, which has consisted entirely of dredging, began in November, 1882; up to June 30, 1883, 91,210 cubic yards of material had been removed.

In order to complete a channel through from the Stono to the Ashley River with the small appropriation available, the proposed width of 90 feet was reduced to an average of 65 feet.

The dredging was carried to a depth of 6 feet at mean low water. The work begun on the bar, at the Stono outlet, a width of 60 feet was carried through Elliott's Cut and 50 feet through the reaches to the Marsh Cut, across the Devil's Elbow; the width of the Marsh Cut is about 80 feet.

The route from river to river has been shortened from 5.5 miles to 3.6 miles, and the depth, at mean low water has been increased from 2½ feet at the shoalest parts to 6 feet and over throughout.

The present appropriation will be exhausted about August 15, 1883.

A map of Wappoo Cut accompanies this report.

Table of work done.

	Cubic yards removed.
November, 1882	5,278.30
December, 1882	11,772.90
January, 1883	11,713.40
February, 1883	11,530.54
March, 1883	12,800.28
April, 1883	15,093.48
May, 1883	14,847.80
June, 1883	8,173.70
Total	91,210.40

By the active superintendence of Mr. J. P. Allen, assistant engineer, and his careful locations of cuts, it has been possible to accomplish much more with the means available than was at first contemplated.

Very respectfully, your obedient servant,

THOS. N. BAILEY,
First Lieut., Corps of Engineers.

Col. Q. A. GILLMORE,
Corps of Engineers, U. S. A.

L 3.

IMPROVEMENT OF EDISTO RIVER, SOUTH CAROLINA.

By the river and harbor act passed August 2, 1882, the sum of $8,000 was appropriated for improving Edisto River, South Carolina. This is the first appropriation made by Congress for this work.

The Edisto is one of the principal rivers of South Carolina. It is formed by the junction of the North and South Forks, which unite in the southern part of Orangeburg County. The South Fork, commonly known as the South Edisto, is the main river.

The river was examined under my direction in September and October, 1880, under a provision of section 2 of the act approved June 14, 1880. My report, dated December 31, 1880, with project of improvement, is printed as Appendix J 15 of the Annual Report of the Chief of Engineers for 1881, and also as part of House Ex. Doc. No. 23, Forty-sixth Congress, third session.

It is contemplated to improve the river from Guinguard's Landing, in Aiken County, to the mouth, a total length of 260 miles, so as to establish a safe navigation at all seasons of the year for light-draught steamboats from the sea to the junction of North and South Forks, near the crossing of the South Carolina Railroad, 183 miles from the mouth, and thence to Guinguard's Landing, for rafts and flat-boats. It is not deemed advisable to attempt an improvement of the reaches higher up, which are excessively encumbered with logs and shoals.

The obstructions to navigation are caused by numerous bends, logs, snags, overhanging trees and piles, and by shoals, consisting generally of sand, but at some places of hard clay.

The plan of improvement submitted with my report of December 31, 1880, comprises :

1. Enlargement and clearing of all the new channels now in progress of formation.
2. Forming new channels across necks of bends where needed.
3. Shutting off lateral arms which now weaken the stream.
4. Removal of logs, snags, and pile obstructions.
5. Removal of shoals of sand and clay ; in one case, by building a deflecting jetty.

The total cost of the work is estimated at $33,385.

The total amount expended up to the close of the fiscal year ending June 30, 1883, including outstanding liabilities, was $1,945.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1883.

The United States snag-boat Toccoa, which was built for use on the Savannah River and on the Altamaha River, Georgia, and completed in February, 1882, after finishing its allotted season's work on the Savannah River, between Augusta and Savannah, was sent to the Edisto, where she was employed during the months of March, April, and May, 1883.

The river channel was cleared of a considerable number of piles, snags, and overhanging trees ; a narrow cut-off only 18 feet long, through the neck of a bend three-quarters of a mile around, known as the "Suck" at Norman's Landing, 50 miles above Jacksonborough, was successfully widened and deepened, and now forms the regular channel of the river at that place ; and a number of leaning trees and limbs were cut down.

The operations extended from the mouth of the Edisto to Russell Lake, a distance of 110 miles. A draw in the Charleston and Savannah Railroad Bridge at Jacksonborough, 39 miles above the mouth, enabled the snag-boat to proceed as high up as stated. The upper or South Carolina Railroad Bridge has no draw.

The appropriation was not exhausted when the boat was withdrawn. It could not reach the obstructions remaining to be removed, as proposed, with the funds still available. These obstructions consist chiefly of large cypress stumps, often in mid-channel, and measuring from 6 to 12 feet in diameter. The snag-boat could not get at these obstructions during the season of low river, when operations for their removal can best be carried on.

OPERATIONS CONTEMPLATED DURING THE PRESENT FISCAL YEAR.

During the fiscal year beginning July 1, 1883, operations will be continued by means of the balance on hand that day, amounting to $6,055.

It is proposed to remove those obstructions that could not be reached by the snag-boat. It will probably be best to employ hired labor, procuring such outfit and material as may be necessary for doing the work most efficiently.

In regard to the question of the amount of commerce and navigation that may be benefited by completing the improvement, I have to state that I have received no additional information since rendering my report on the Edisto, dated December 31, 1880, that would enable me to discuss it in a sufficiently comprehensive manner. I may substantially repeat what I said in that report on the subject. An improvement of the river as contemplated will undoubtedly result in a great development of the timber and lumber business. It is known that an immense amount of valuable timber of various kinds covers large tracts

of land in the vicinity of the upper reaches of the river. The trade in these products will continue to be restricted to the season of high water, until the improvement, recently commenced, shall have been completed.

Extensive areas of land on the banks of the lower reaches are well adapted for rice culture.

This improvement is located in the collection district of Charleston. Charleston, Beaufort, and Savannah are the nearest ports of entry.

The amount of duties collected on imports at the custom-house at Charleston during the calendar year 1882 was $45,268.33.

The report of Lieut. T. N. Bailey, Corps of Engineers, is transmitted herewith.

Money statement.

Amount appropriated by act passed August 2, 1882	$8,000
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	1,945
July 1, 1883, amount available	6,055
Amount (estimated) required for completion of existing project	25,385
Amount that can be profitably expended in fiscal year ending June 30, 1885	25,385

REPORT OF LIEUTENANT THOMAS N. BAILEY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., July 2, 1883.

COLONEL: I have the honor to submit the following report of operations during the past fiscal year for improving Edisto River, South Carolina. The United States snag-boat Toccoa began work on this river on the 22d of March and suspended operations on the 22d of May, 1883. The boat was engaged in removing piles, snags, and similar obstructions from the channel; in cutting down leaning trees which were liable to form snags; in clearing the channel of overhanging trees and limbs which obstructed navigation, and in enlarging a cut near Norman's Landing. In the three latter cases, dynamite has been skillfully used by the assistant engineer in charge.

Near Willtown, 30 miles above the mouth of the river, a double row of piles driven during the war, together with the fragments of the wreck of a steamboat, formed a serious obstruction. Part of these piles had been cut off by raftsmen 3 feet below low water. A passage has been cleared through this obstruction 750 feet wide, with a least depth in the channel of 8 feet at mean low water.

A pile obstruction was removed from the mouth of Ash Creek, near Willtown, giving a channel 100 by 6 feet. A number of piles were taken out from near the Charleston and Savannah Railroad Bridge at Jacksonborough, 39 miles above the river mouth. From Jacksonborough to Russell Lake, a distance of 71 miles, the river has been cleared of snags and leaning trees, so as to permit the passage of steamboats drawing 3 feet of water, which was impracticable before this work was done.

At Norman's Landing Suck, 50 miles above Jacksonborough the river foms a bend three-quarters of a mile long, while the narrow "Suck" across the bend was but 18 feet in length. This suck, which was much dreaded by raftsmen, has been cleared out; a least width of 105 feet, with at least 7 feet of water, has been secured. The raftsmen are now using the cut with satisfaction. The remaining obstructions, which may be removed by using the balance of the current appropriation, consist principally of cypress stumps, often in mid-channel and measuring from 6 to 12 feet in diameter.

The snag-boat cannot reach these obstructions during the low-water season, when operations for their removal are best undertaken. It is thought that this work can be accomplished through hired labor operating from a light flat and using high explosives freely.

SUMMARY.

Number of logs, snags, &c., removed	77
Number of piles removed	124
Number of overhanging trees moved	248

Mr. J. H. Westerfield, assistant engineer in charge of the boat, deserves much commendation for energy and skill displayed.

Very respectfully, your obedient servant,

THOS. N. BAILEY,
First Lieut., Corps of Engineers.

Col. Q. A. GILLMORE,
Corps of Engineers, U. S. A.

L 4.

IMPROVEMENT OF SALKIEHATCHIE RIVER, SOUTH CAROLINA.

By the act of Congress passed August 2, 1882, the sum of $5,000 was appropriated for improving Salkiehatchie River, South Carolina, this being the first appropriation made by Congress for the work.

This river was examined under my direction in the latter part of 1880, under a provision of section 2 of the act approved June 14, 1880. My report, with an estimate of the cost of improvement, dated December 29, 1880, is printed as Appendix J 16 of the Annual Report of the Chief of Engineers for 1881, and as part of House Ex. Doc. No. 23, Forty-sixth Congress, third session.

The Salkiehatchie River, also named the Big Salkiehatchie, to distinguish it from one of its tributaries, known as the Little Salkiehatchie, rises in Aiken County, South Carolina. These two rivers unite about 80 miles from the Atlantic seaboard. About 24 miles below the junction the Salkiehatchie is spanned by the Charleston and Savannah Railroad Bridge. Farther down, the river is known as the Combahee, but it is not definitely known at what point the change of name takes place.

The results of the examination, which extended from the point where Toby's Creek enters the Salkiehatchie down to Hickory Bluff, 12 miles below the railroad bridge, an aggregate length of about 155 miles, showed that it would not be expedient to attempt to improve the river above a point 65 miles above the bridge. The regimen of the stream in this upper section was found to be irregular and deflective to an excessive degree. At several places it actually ceases to be a stream, and becomes divided into great numbers of insignificant channels. It is believed that the cost of improving these reaches would be quite out of proportion to the benefits that could be realized.

PROJECT OF IMPROVEMENT.

The project submitted with my report of December 29, 1880, contemplates the creation of a continuous and practicable channel for rafts and flat-boats in the lower reaches of the river, from a point 5 miles above Toby's Bluff down to Hickory Bluff, 12 miles below the railroad bridge, comprising a total length of river of 77 miles. On this length there are two places, named Murdock's Sand Drags and Weekly Sand Drags respectively, where the stream divides into numerous small channels, but above and below the river is in a more satisfactory condition. Below Hickory Bluff and down to the sea the river is free and open for all purposes of traffic needed.

The work to be done consists in removing piles at Hickory Bluff, and the removal of logs and of the shoals accumulated around them in the reaches above the bridge. Through Murdock's and Weekly Sand Drags cuttings must be made to form a channel of sufficient dimensions for rafts and flat-boats.

The cost of this improvement is estimated at $18,000.

The total amount expended up to the close of the fiscal year ending June 30, 1883, including outstanding liabilities, was $587.50.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1883.

But little work has been done thus far. It had been proposed to expend the appropriation of $5,000 made for the Salkiehatchie River in removing piles, snags, and other obstructions in the lower reaches, and

to employ, as far as practicable, the United States snag-boat Toccoa for the purpose. She will be limited in her operations to the lowest 12-mile reach; she cannot pass the Charleston and Savannah Railroad Bridge, which has no draw.

During the greater portion of the last fiscal year the snag-boat was engaged on the Savannah River, below Augusta, Ga., and on the Edisto, South Carolina. She could not begin work on the Salkiehatchie before the middle of June, 1883. She has successfully removed a number of piles at Hickory Bluff, and snags, overhanging trees, and other obstructions for 9 miles above that point.

OPERATIONS CONTEMPLATED DURING THE PRESENT FISCAL YEAR.

With the balance of funds on hand July 1, 1883, $4,412.50, operations will be continued in accordance with the existing project.

The snag-boat will be employed in clearing the channel of the river of all obstructions to navigation between Hickory Bluff and the railroad bridge, when she will be withdrawn. With the funds that may then remain on hand it is proposed to begin operations above the bridge, in which case it will probably be recommended to do the work by hired labor and purchase of the requisite material in open market.

I have nothing to add at the present time to the statement made in my report of December 29, 1880, that the improvement will undoubtedly aid the timber and lumber trade of the country adjacent to the river, and would perhaps develop some local movement in naval stores.

The work is located in the collection district of Charleston, S. C. Beaufort is the nearest port of entry.

The report of Lieut. T. N. Bailey, Corps of Engineers, is transmitted herewith.

Money statement.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, outstanding liabilities	587 50
July 1, 1883, amount available	4,412 50
Amount (estimated) required for completion of existing project	13,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	13,000 00

REPORT OF LIEUTENANT THOMAS N. BAILEY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., July 3, 1883.

COLONEL: I have the honor to submit the following report of operations during the past fiscal year for "improving Salkiehatchie River, South Carolina."

The United States snag-boat Toccoa was at work in this river from June 14 to 30, 1883.

At Hickory Hill, 46 miles above the river mouth, a double row of piles, driven during the war, obstructed navigation. The snag-boat was unable to draw these piles, but a channel was cleared through them by cutting off sixteen piles at the river bottom by means of Hercules powder. The boat then cleared a channel for 9 miles above Hickory Hill, by the removal of twenty-three snags, twenty overhanging trees, and three stumps. The clearing of the channel for light-draught steamers will probably be completed as far as the Charleston and Savannah Railroad Bridge by July 15, 1883.

The snag-boat cannot pass above this bridge. It is expected to begin work, by hired labor, on the upper part of the river at an early date.

Very respectfully, your obedient servant,

THOS. N. BAILEY,
First Lieut., Corps of Engineers.

Col. Q. A. GILLMORE,
Corps of Engineers, U. S. A.

L 5.

IMPROVEMENT OF ASHLEY RIVER, SOUTH CAROLINA.

Two appropriations for improving Ashley River, South Carolina, have thus far been made by Congress, one of $1,000, by act approved June 14, 1880, and another of $1,500, by act approved March 3, 1881.

Ashley River was examined and partially surveyed under my direction under a provision of the act of March 3, 1872. My report, with project of improvement, is printed as Appendix S 8 of the Annual Report of the Chief of Engineers, for 1873.

The plan of improvement recommended comprised—

1. The removal of a shoal or bar at a place known as Accabbee, between 7 and 8 miles above Charleston City, where only 9 feet of water at mean low tide was found in 1873, while the channel of approach to it from below was only about 40 feet in width between the 10-foot curves.

2. The removal of a shoal at a point below the Wando Phosphate Works, about 2 miles above Accabbee, where only 6 feet of water was found at low tide.

It was proposed to lower these shoals by dredging to a low-water depth from 10 to 11 feet.

The cost of the work was estimated at $5,000.

Nearly the whole aggregate amount of $2,500 available for this improvement on July 1, 1881, was expended during the fiscal year commencing on that day, as I stated in my annual report of 1882. A channel was dredged at the shoal or crossing near the Wando Works, about 100 feet wide and over 1,000 feet long, establishing a depth of 11 feet at mean low tide. After completing this work, a balance of $85.07 remained on hand.

The total amount expended up to the close of the fiscal year ending June 30, 1883, including outstanding liabilities, was $2,412.93.

No work was done during the past fiscal year, since no appropriation had been made for that purpose.

The sum of $2,500 is required to complete the work of improvement under the existing plan.

I have to repeat, what I stated in my last annual report, that it is not certain, after carrying out the proposed works, that the improved channel obtained by dredging will preserve the depths gained thereby; that dredging will have to be repeated occasionally, and that some jetties or wing-dams will be needed to control the current and to render the improvement permanent. It is not considered necessary at present to submit a project and estimate of the cost of works for permanently securing a minimum low-water depth of from 10 to 11 feet at the shallow places in Ashley River.

This improvement directly aids the business of the several phosphate works located above the shoals referred to, and indirectly benefits the commerce of the city of Charleston.

This work is located in the collection district of Charleston, S. C. Charleston is the nearest port of entry. Amount of duties collected in 1882, $45,268.33.

Money statement.

July 1, 1882, amount available	$85 07
July 1, 1883, amount available	85 07
Amount (estimated) required for completion of existing project	2,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	2,500 00

L 6.

IMPROVEMENT OF SAVANNAH HARBOR AND RIVER, GEORGIA.

During the past fiscal year operations for improving Savannah Harbor and River, Georgia, were carried on in conformity to the enlarged project submitted with my report, dated January 16, 1882, of an examination made in 1881 for the further improvements necessary in Savannah Harbor and River.

This examination had been made in accordance with section 3 of the river and harbor act, approved March 3, 1881, which provided that an examination or survey, or both, with estimates of cost of improvement proper, should be made in the Savannah River, to increase the depth of water in said river and harbor from the bar up to the city to 22 feet, and to make an estimate of the cost of widening the channel of the Savannah River opposite the city to 600 feet, of uniform depth with the balance of the channel.

My report of this examination is printed with Appendix J 4, Annual Report of the Chief of Engineers for 1882, and as Senate Ex. Doc. No. 19, Forty-seventh Congress, first session.

During the two years preceding the autumn of 1873, Congress had appropriated the sum of $100,000 for improving the river below the city of Savannah, which was expended mainly in removing wrecks, cribs, and other obstructions.

By act approved February 27, 1874, the sum of $193,132.96, was appropriated for the relief of Mr. Henry S. Wells, for work done by him in removing wrecks, cribs, &c., under contracts with the Treasury Department of May 1, and July 5, 1866.

PLANS OF IMPROVEMENT.

The project under which operations have lately been carried on is an enlargement of two previous projects, dated August 28, 1873, and March 19, 1879, respectively.

The work proposed to be done according to the earlier project comprised chiefly the widening of the water-way at the city front, and in deepening, widening, and straightening the channel by dredging at various points below the city, to the vicinity of Tybee Roads. A dam at the Cross Sides, 4 miles above the city, and a short bulk-head on the Hutchinson's Island side, opposite the upper part of the city, also formed part of the plan.

By the supplementary project of March 19, 1879, it was designed to make the north channel of the Savannah River the subject of improvement in preference to the south channel, from the head of Elba Island to the head of Long Island. The new features of the plan consisted in the construction of a low dam across the upper end of the south channel, closing the lateral channels connecting the north and south channels from Elba Island to Cockspur Island, and in providing for shore protections.

The third or enlarged plan of improvement embraced in my report of January 16, 1882, while retaining all the features of the two preceding projects, provides for a number of works that are judged to be necessary for the further improvement of the channel of navigation from Tybee Roads to the city of Savannah, with a view of rendering said improvement practically permanent. For the details of this enlarged project I beg leave to refer to my annual report for the year ending June 30, 1882.

The total cost of the improvement is estimated at $730,000, in addition to the sum of $482,000, which is the aggregate amount of appropriations made for this improvement from the beginning of work in 1874 to 1881, inclusive.

BRIEF RECAPITULATION OF WORK DONE PRIOR TO JULY 1, 1882.

At Cross Tides a submerged dam was constructed, formed of brush mattresses and a superstructure of riprap stone. On June 30, 1882, the crest of the work had been raised to the height of 3 feet above the level of mean low water. The adjoining banks were protected from scour by log mattresses covered with riprap stone.

About 70 feet in length of the old King's Island crib-jetty was removed to increase the flow of water in Front River.

Between King's Island and Hutchinson's Island, and lower down in Front River to the city of Savannah, about 96,500 cubic yards of material was removed by dredging to facilitate the inflow of the tide.

Dredging aggregating 242,289 cubic yards of material was done in Front River to increase the depth of water on Garden Bank Shoal and to widen the river to a width of 660 feet by cutting off the projecting point of Fig Island, opposite the wharves of the Savannah, Florida and Western Railroad.

Two substantial wing-dams were constructed in the river opposite the lower portion of the city to produce stronger currents by reducing the width of the water-way at Garden Bank Shoal. Their shore ends rest on Fig Island, and they are formed of log mattresses and riprap stone. They contract the water-way to a width of about 650 feet. Formerly it was from 900 to 1,050 feet.

About 467,000 cubic yards of material was removed by dredging from the new channel at "The Wrecks" in the years from 1876 to 1882. Previously, about 142,000 cubic yards had been removed from the old or Fig Island Channel, the improvement of which was abandoned in 1875, as recommended in my letter to the Chief of Engineers, dated May 13, 1875.

A jetty or training-wall was constructed, extending 5,000 feet due east from a point a little above the lower end of Fig Island, with which it is connected by a return about 160 feet in length. Its crest was generally raised to the height of about 3 feet above mean low water. It was so located that the future width across the new channel at "The Wrecks," between the jetty and the proposed bulkhead line in front of the south bank of the river, should vary from 800 feet at the upper end to 880 feet at the lower end of the work. The jetty is constructed of log matresses covered with riprap stone.

During the period named more or less dredging was executed in the lower reaches of the river from the "Obstructions" at the head of Elba Island down to Tybee Knoll, aggregating about 406,260 cubic yards.

Three side channels, formerly connecting the north and south channels below Elba Island, were closed by dams. One of the dams shuts off Philbrick's Cut at the east end of Elba Island, another runs across the channel between Island One and Two and Bird Island, and the third dam closes the channel between Bird and Long islands. These dams were formed of log mattresses and riprap stone; their aggregate length amounts to about 3,250 feet. On June 30, 1882, they had been finished up to the level of ordinary high water.

A submerged dam or sill was built across south channel near its upper end. A number of wrecks of large vessels and portions of wrecks,

as well as piles, cribs, and other obstructions, were removed from the ship channel.

The appropriations made for this work of improvement in the years from 1873 to June 30, 1882, aggregate $482,000; the total expenditures, $466,948.08.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1883.

During the past fiscal year operations were carried on by means of the balance of $15,051.92 on hand on July 1, 1882, and of the appropriation of $200,000 made by act of Congress passed August 2, 1882.

The work done consisted, substantially, in constructing dams for contracting the water-way between the city and the central part of Elba Island, in closing lateral channels on either side of Barnwell Island, and in dredging at various places in front of and below the city. A considerable amount of surveying was executed for the purpose of locating the new works and for ascertaining recent changes of the river-bed.

The contract for dredging, made on June 2, 1882, with Messrs. Dickerson & Paulsen, was closed in July of the same year, in which month they had removed 17,238 cubic yards of material from Garden Bank Shoal, which amount, together with 18,364 cubic yards excavated during the preceding month, completed their work.

Proposals were invited by circular letter, August 15, 1882, for furnishing the material required for the various kinds of dams proposed to be built during the fiscal year, to wit, log mattresses, brush, and riprap stone. Five bids were received which were not considered quite satisfactory, excepting one, in which, however, only riprap stone was offered without the other material. Mr. E. A. Smith, of Savannah, Ga., who made this bid, offered to supply the stone at the price of $2.92 per cubic yard. This was the lowest bid of its class. A limited amount of stone was accepted from him at that price, but the purchase was discontinued when, with the approval of the Department, new proposals were called for, under date of September 26, 1882, for constructing wing-dams and training-walls, including both material and labor.

The following is an extract from the specifications:

Under these specifications it is the intention to continue the construction of dams, wing-dams, and training-walls at such points as the engineer in charge shall designate between the upper limit of the city of Savannah and Tybee Roads, and the work will consist essentially in building up said dams, wing-dams, and training-walls, with successive courses composed of log and brush mattresses, overlaid with riprap stone, and in putting riprap stone alone upon the works wherever required. Additional stone will be placed upon the Cross Tides Dam under these specifications, if the engineer in charge shall so direct.

The mattress is simply a raft of round logs, not less than 12 inches in average diameter, and not less than 9 inches in diameter at the small end, placed in close contact, side by side, at right angles to the line of the wall or dam, and held firmly there by transverse pole-binders spiked or bolted to them.

The binders, with the exceptions noted below, will be smaller logs or poles, not less than 4 inches in diameter at the small end, and placed not more than 8 feet apart, and those on the outside will be close to the end of the logs. The exceptions are that two of the binders will be not less than 12 inches in diameter at the small end. These large binders or stringers are to sustain the mattress next following in the course above, and will be placed one on either side of the center line of the mattress at such distances therefrom as the engineer in charge shall direct.

The space between the large binders or stringers will be closely filled up with compact bundles of brush, placed parallel to the logs of the mattress, to such depth as to give a thickness of not less than 10 inches when compacted in the finished work, to be overlaid with a course of brush, placed transversely thereto, to such a depth as to give a thickness of 2 to 3 inches when compacted in the finished work, the whole to be secured in place by pole-binders, in such manner as the engineer in charge shall approve.

Outside the large binders or stringers the logs of the mattress will also be overlaid with brush to an estimated depth of not less than 2 inches when compacted in the finished work. This brush will be secured in place by suitable binders, in such manner as the engineer in charge shall approve.

The logs and binders used may be of loblolly or other cheap variety of pine, and must be of gentle taper, and as straight as can be procured, and the brush will be live, hard-wood brush.

The mattress will be laid in sections of convenient length in juxtaposition, and each section will be made of the full width of the mattress course, as fixed by the engineer in charge during the progress of the work.

This width may vary from 10 feet to 40 feet.

Gaps between the edges of adjacent sections of mattress will be considered as having been filled with stone by the contractor, to be paid for at a price equal to the price of the mattress work.

Where one section of mattress laps over another, the lap will not be paid for, and the engineer in charge will be the sole judge whether mattress work will be accepted in which the sections either lap over each other or have gaps between them, or are not placed on the line of the dam with sufficient accuracy.

The stone will be sound, dense, of compact form, and of suitably random sizes, varying in weight from 15 to 200 pounds. When received by weight, 2,800 pounds will be required to the cubic yard; when received by measurement, the stones will be fairly piled upon scows or lighters. Loads of stone submitted for measurement, that contain any appreciable quantity of defective stone, or that are loosely or not fairly loaded, or so loaded that they cannot be accurately measured, will not be accepted.

The general depth of stone covering the mattress will be from 6 inches to 1 foot, at the option of the engineer in charge, to be distributed as said engineer shall direct, but the right is reserved to place additional stone at points on any of the works, where, in the opinion of the said engineer, it is considered to be necessary.

It is estimated that under these specifications from 120,000 to 140,000 square yards of mattress work, and from 15,000 to 20,000 cubic yards of stone, will be required.

The work, as it progresses, will be and remain at the risk of the contractor until it has received its specified quantity of stone, and until it has been accepted, after suitable inspection.

Bidders are required to name a price per square yard for mattresses in the work, and a price per cubic yard for stone in the work.

The bids received were considered too high, excepting one which could not be accepted owing to a serious irregularity. The Department authorized the rejection of all bids and the readvertisement of the work, which was done on November 4, 1882. Under this last call Mr. Eli T. Bangs, of Fayetteville, New York, was the lowest bidder. He offered to supply and put in the work log mattresses at the price of 57 cents per square yard, and riprap stone for $3.10 per cubic yard. A contract was concluded with him on December 20, 1882.

With the approval of the Department, this contract was supplemented by an agreement dated March 9, 1883. It had been found that for narrow mattresses of 15 feet width and thereabouts, the use of the large central binders, required under the specifications, was objectionable, since they rendered the mattresses unmanageable and too heavy and too rigid to adjust themselves to the irregularities of the bottom, or of work previously laid. Binders of only 6 inches diameter were substituted in their place, and as an offset for this loss of material, the logs forming the body of the mattress were increased in size from 12 inches diameter to 15 inches. The price to be paid to the contractor per square yard of mattress remained unchanged.

A contract for dredging about 200,000 cubic yards of material, more or less, was concluded, after the usual advertisement of the work, on December 30, 1882, with Messrs. Dickerson and Paulsen, of Savannah, Georgia. They agreed to remove the material at the price of 16½ cents per cubic yard.

As to the details of the operations I have to report as follows:

Cross Tides Dam.—About 706 cubic yards of stone were distributed over the work.

Improving the water-way opposite the city front and at Fig Island.—A third wing-dam was built 660 feet below the lower one of the two that were built during the preceding fiscal year. It rests on Fig Island; its length is 250 feet, and it is constructed like the others; 23,191.5 cubic yards of material were removed by dredging from Garden Bank Shoal.

New channel at "The Wrecks."—The Fig Island jetty or training-wall was extended down-stream about 1,000 feet. The width of the foundation course of mattresses in the extension varied from 55 to 70 feet; that of the upper courses from 15 to 30 feet. The crest of the work rises to a height from 2 to 3 feet above low water. The easterly end rests in 15 feet of water, low tide. Some mattresses and stone were placed upon the older part of the jetty to bring it up to the required height where it had settled.

Eleven short spurs were added to the jetty at right angles to the channel line on its south side, for better confining the currents in the channel at "The Wrecks." They vary in length from 110 feet to 190 feet; their aggregate length is about 1,600 feet. They are composed of from one to three courses of log and brush mattresses covered with rip-rap stone; the bottom course is uniformly 30 feet in width, the others 15 feet. Each spur has a protecting mattress apron at its outer end, measuring 50 by 40 feet.

The heads of the spurs are so aligned that the low-water width of the water-way between them and the opposite shore, increases from 680 feet at the upper end to 740 feet at the lower end.

A similar spur was built about 480 feet above the upper end of the Fig Island jetty to narrow the water-way in that vicinity. Its length is 225 feet.

All these spurs rise from 2 to 6 feet above the level of mean low water; 83,180 cubic yards of material were dredged from the channel at "The Wrecks," of which amount 11,737 cubic yards were removed by the United States dredge steamer Henry Burden and the balance by contract.

Closing dams at Barnwell Island.—To increase the flow of water in the ship-channel at the head of Elba Island, two minor channels, one at either side of Barnwell Island, were closed by dams.

Dam No. 5 shuts off the channel between the island and the shore of South Carolina, while Dam No. 11½ closes the passage between Barnwell Island and another island named Barnwell Island No. 2. The aggregate length of these dams is about 1,200 feet; they consist of from one to five courses of log and brush mattresses and riprap stone, according to the depth of water, and they generally rise to the level of high water.

Head of Elba Island.—A wing-dam, numbered 15 on the chart, extends to a length of 880 feet from the little mud island named Barnwell Island No. 3. It reduces the width of the water-way at that place to 1,000 feet.

From the shoal at the obstructions, some distance above the wing-dam, 29,084 cubic yards of material were removed by dredging.

Upper Flats.—One pair of wing-dams, numbered 4 and 23, respectively, now contract the water-way of the channel where it leaves the confines of the passage between Spirit Island and the main land of South Carolina. Wing-dam No 4 extends 360 feet from the lower end of Spirit Island; the length of No. 23, opposite to it, is 560 feet. Between their heads, the width of the water-way, which was over 1,900 feet, is now reduced to 1,000 feet. Their bottom courses of mattresses vary from 30 to 40 feet in width, with a toe or apron mattress at the outer end

measuring 50 by 60 feet. Their shore-ends rise to the level of high water, descending thence to a level of 5 feet above low water, which height is maintained to within 200 feet of the outer end, from which point it gradually descends to the level of the top of the toe. The upper courses are 15 feet wide.

Another pair of wing-dams, Nos. 6 and 25, was placed about 2,400 feet lower down; their lengths are 880 feet and 1,980 feet, respectively. The river has here a width of 3,700 feet; it is reduced to 1,000 feet between the heads of the wing-dams. No. 25 was not quite completed at the end of the fiscal year.

Closing dams below Elba Island.—These dams, three in number, which close the side channels connecting the north and south channel below Elba Island, were built during the fiscal year ending June 30, 1882. Since that date the dam at Philbrick's Cut, next to Elba Island, and Big Gap Dam, between Island 1 and 2 and Bird Island, had settled several feet. By distributing 1,168 cubic yards of stone over them, their crests were again raised to the height of from 4½ to 5 feet above low water.

A total length of 8,935 linear feet of new dams of all descriptions was constructed during the past fiscal year. For rebuilding these dams and repairing old work there was used 73,669 square yards of log and brush mattresses, and 21,095 cubic yards of riprap stone.

The material removed by dredging aggregated 135,456 cubic yards.

CONDITION OF THE WORK AND CHANGES OBSERVED IN THE RIVER.

The dam at Cross Tides, 4 miles above the city of Savannah, the crest of which reached a height of about 3 feet above low water in June, 1882, has settled during the past fiscal year. On about half of its length the crest is now at the level of low water; the other half has sunk from 4 to 6 feet lower. A strong ebb-current sets across the work in the direction of Back River.

Satisfactory progress has been made in the work of improving the river at Garden Bank Shoal. Along the reach comprising the three wing-dams, the channel shows a depth exceeding 22 feet at high water, on a width of more than 200 feet. The dams are in good condition, and are expected to maintain and probably increase the favorable effects attained.

The Fig Island jetty remained in good condition except that it settled at some places. These defects were repaired. Considerable shoaling has taken place north of the jetty, and in the intervals between the spurs on the south side, sand is accumulating.

The channel at "The Wrecks" is now wider, deeper, and more uniform than it has been at any previous time. It has not yet attained throughout the minimum depth of 15 feet, low tide, as required. To improve the channel permanently, as designed, will require the raising of the dam at Cross Tides, and probably of the Fig Island jetty, to the level of high water, besides some additional dredging.

A low-water depth of 15 feet has been obtained by dredging in the channel at the "Obstructions" at the head of Elba Island.

The wing-dam opposite the head of Elba Island, and the works lower down in the north channel, are of recent construction, and have apparently not yet produced any changes in the river bed.

SAVANNAH HARBOR AND RIVER GA.

PROGRESS SHEET No 1.

IN FRONT OF LOWER HALF OF SAVANNAH CITY

SHOWING GARDEN BANK SHOAL AND THREE FINISHED WINGDAMS.

From a survey made in May 1883 under the direction of

Colonel Q. A. Gillmore, Corps of Engineers, Brvt. Maj. Gen. U.S.A.

by First Lieut. Thos. N. Bailey, Corps of Engineers,

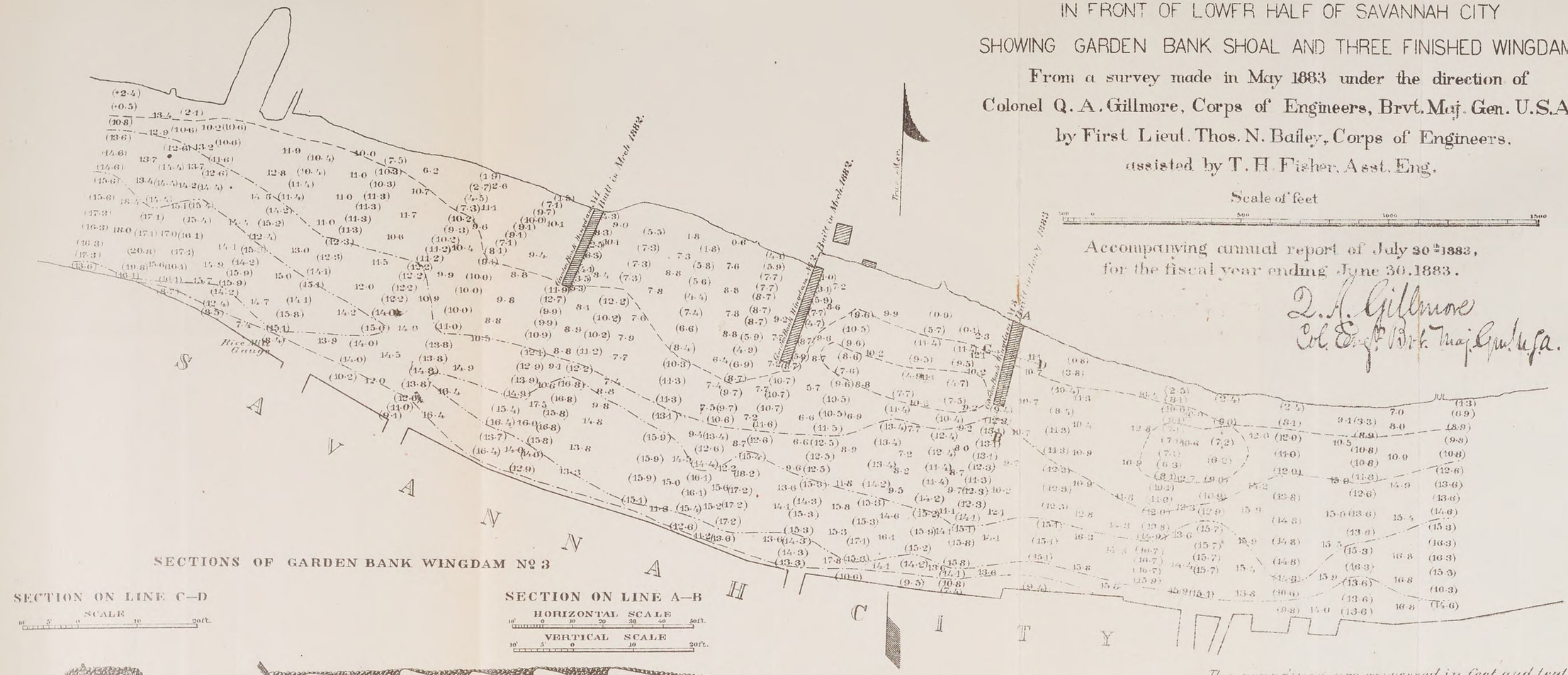
assisted by T. H. Fisher, Asst. Eng.

Scale of feet

500 0 500 1000 1500

Accompanying annual report of July 30th 1883,
for the fiscal year ending June 30. 1883.

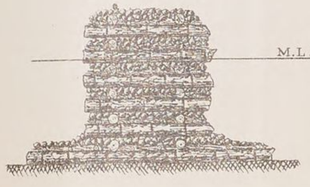
Q. A. Gillmore
Col. & Lt. Brvt. Maj. Gen. U.S.A.



SECTIONS OF GARDEN BANK WINGDAM No 3

SECTION ON LINE C—D

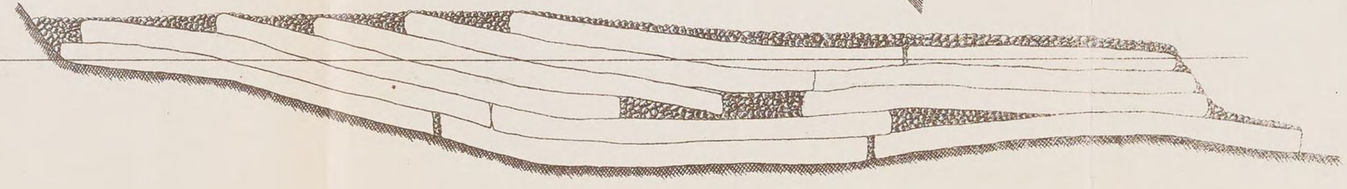
SCALE 10' 5' 0 10 20ft.



SECTION ON LINE A—B

HORIZONTAL SCALE 10' 0 10 20 30 40 50ft.

VERTICAL SCALE 10' 5' 0 10 20ft.



The soundings are expressed in feet and tenths and reduced to Mean Low Water by the Rice Mill Gauge. The soundings placed within brackets ( ) were taken May 12th and 13th 1883. The others were taken December 1881.

The 9 foot curve is marked ———————

" 12 " " " " — · — · — · —

" 15 " " " " — — — — —

SAVANNAH HARBOR AND RIVER GA.

PROGRESS SHEET Nº 2.

SHOWING WORKS CONSTRUCTED FROM THE LOWER END OF FIG ISLAND TO THE VICINITY OF FT JACKSON TO JUNE 30,1883.

Under the direction of

Colonel Q. A. Gillmore, Corps of Engineers, Bvt. Maj. Gen. U.S.A.

First Lieut. Thos. N. Bailey, U.S. Corps of Engineers, in local charge.

T. H. Fisher, Asst. Eng.

Scale of feet.

Accompanying annual report of July 30th 1883,
for the fiscal year ending June 30, 1883.

D. A. Gillmore
Col. Engrs. Bvt. Maj. Gen. U.S.A.

The soundings are expressed in feet and tenths and are reduced to Mean Low Water by the Ft. Jackson Gauge.

Soundings marked thus 3.6, 4.5 were taken December 1881,
" " " 2.7, 3.1 " " *May 1883,*
" " " 5.0, 7.2 " " *June 29, 1883.*

The 9 feet curve is marked thus: _____

" 12 " " " " " :

" 15 " " " " " :

Work done in 1882 is marked

" " " 1883 " "

FIG ISLAND

FIG ISLAND JETTY

Ft. Jackson

Wingdam Nº 1 above Fig Island Jetty
Section A–B

Spur Nº 3
Section C–D

Spur Nº 11
Section H–I

Extension, Fig Island Jetty
Section E–F

Mean Low Water Line

Scale of Sections

Horizontal

Vertical

SAVANNAH HARBOR AND RIVER GA.

PROGRESS SHEET Nº 3.

SHOWING WORKS CONSTRUCTED BETWEEN BARNWELL ISLAND AND LONG ISLAND

TO JUNE 30, 1883.

Under the direction of

Colonel Q. A. Gillmore, Corps of Engineers, Bvt. Maj. Gen. U.S.A.

First Lieut. Thos. N. Bailey, U.S. Corps of Engineers, in local charge.

T. H. Fisher, Asst. Eng.

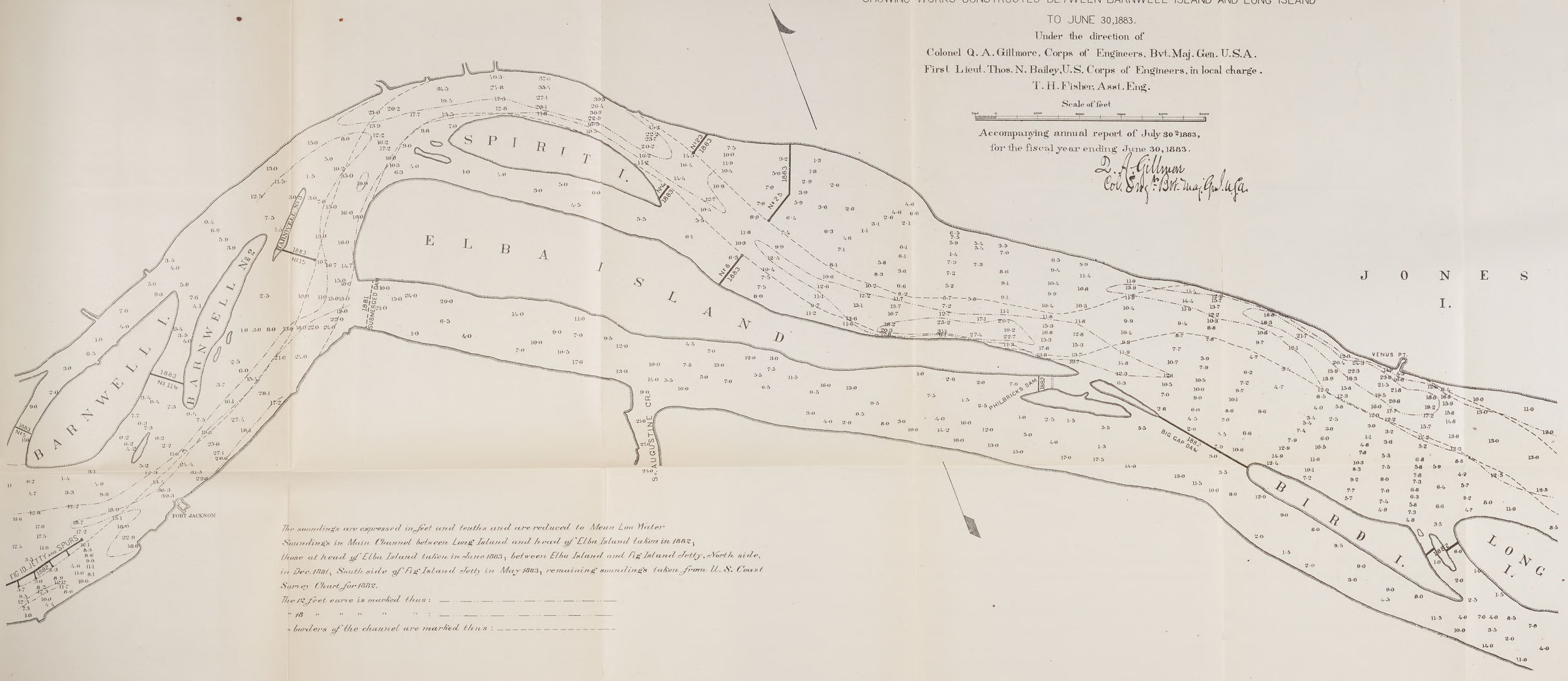
Scale of feet

Accompanying annual report of July 30th 1883,

for the fiscal year ending June 30, 1883.

Q. A. Gillmore

Col. Engrs. Bvt. Maj. Gen. U.S.A.



The soundings are expressed in feet and tenths and are reduced to Mean Low Water.

Soundings in Main Channel between Long Island and head of Elba Island taken in 1882;

those at head of Elba Island taken in June 1883; between Elba Island and Fig Island Jetty, North side,

in Dec. 1881, South side of Fig Island Jetty in May 1883, remaining soundings taken from U. S. Coast

Survey Chart for 1882.

The 12 feet curve is marked thus: — — — — — —

" 18 " " " " " : — — — — — —

borders of the channel are marked thus: — — — — — —

OPERATIONS CONTEMPLATED DURING THE PRESENT FISCAL YEAR.

The work of improving Savannah Harbor and River will be continued with the balance on hand July 1, 1883, amounting to $61,015.62.

It is proposed to expend this sum in building additional wing-dams near the lower end of Elba Island; in removing material by dredging where it may promise the best results; perhaps in raising the dam at Cross Tides to a higher level, and in necessary surveys and examinations.

No new information has come to hand bearing on the question of the amount of commerce and navigation that may be benefited by completing the existing project of improvement. I beg leave to call attention to the remarks made on the subject in my annual report of 1881, and to the letter of the mayor of the city of Savannah, transmitted with my annual report of 1882.

This work is located in the collection district of Savannah at the port of entry. Amount of duties collected in 1882, $61,148.70.

Since the works of improvement were commenced the following appropriations have been made:

By act of Congress approved June 23, 1874	$50,000
By act of Congress approved March 3, 1875	70,000
By act of Congress approved August 14, 1876	62,000
By act of Congress approved June 18, 1878	70,000
By act of Congress approved March 3, 1879	100,000
By act of Congress approved June 14, 1880	65,000
By act of Congress approved March 3, 1881	65,000
By act of Congress passed August 2, 1882	200,000
Total	682 000

Of this amount there has been expended up to the close of the fiscal year ending June 30, 1883, including outstanding liabilities, the sum of $620,984.38. This amount also includes the sum of $1,000 paid during the past year for land cut off from Fig Island to widen the river.

To complete the work of improving Savannah Harbor and River in accordance with the project dated January 16, 1882, further appropriations are required to the aggregate amount of $530,000.

The following drawings and papers accompany this report:

Sheet 1. Sketch of Garden Bank Shoal with three wing-dams.

Sheet 2. Sketch showing works constructed from the lower end of Fig Island to the vicinity of Fort Jackson.

Sheet 3. Sketch showing works constructed from Barnwell Island to the head of Long Island.

Report of Lieut. T. N. Bailey, Corps of Engineers.

Letter of mayor of Savannah, with commercial statistics of the port, and statement of chief articles of export.

Money statement.

July 1, 1882, amount available		$15,051 92
Amount appropriated by act passed August 2, 1882		200,000 00
		215,051 92
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$116,591 21	
July 1, 1883, outstanding liabilities	37,445 09	
		154,036 30
July 1, 1883, amount available		61,015 62
Amount (estimated) required for completion of existing project		530,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		530,000 00

Abstract of proposals for constructing wing-dam and training-walls in Savannah Harbor and River, Georgia, opened November 4, 1882.

No.	Names and addresses of bidders.	Mattresses	Riprap stone.
		Per sq. yd.	*Per cu. yd.*
1	William H. Browne, Brooklyn, N. Y	$0.64¾	$3 19
2	Smith and Whitesides, Savannah, Ga	0.63	3 24
3	Newton and Eckstein, New York, N. Y.	0.57	3 35
4	Eli T. Bangs, Fayetteville, N. Y	0.57	3 10

Contract awarded to Eli T. Bangs; dated December 20, 1882; to commence December 20, 1882; to complete August 1, 1883.

Abstract of proposals for dredging in Savannah River, Georgia, opened November 11, 1882.

Name and address of bidder.	Price.	Date of commencement.	To complete.
	Per cu. yd.		
Dickerson & Paulson, Savannah, Ga	$0.16½	Dec. 1, 1882	15,000 cubic yards per month.

Contract awarded at price stated. Work to be completed July 31, 1883.

REPORT OF LIEUTENANT THOMAS N. BAILEY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., July 9, 1883.

COLONEL: I have the honor to submit the following report of operations during the past fiscal year for "improving harbor at Savannah, Ga."

The work has consisted in confining the current by the construction of wing-dams, and in directing and assisting the resulting scour by dredging, following the plans outlined in your report of January 16, 1882.

The dams have been built of log mattresses, from 15 to 50 feet wide, and of an average thickness of 15 inches. The mats are covered with 4 to 9 inches of brush and loaded with from 5 to 9 inches of stone, the top course receiving 13 inches. In profile, the shore ends of the dams are at high-water level, or at the height of the adjacent shore; the crest then slopes down to about 5 feet above mean low water, which height is maintained to within about 200 feet of the outer end of the dam; the crest then falls gradually to the outer end, where a toe or wider lower mat is placed.

A general cross-section, in 10 feet mean low water, would be a lower mat 40 feet wide; above this two 30-feet mats followed by three courses of mats 15 feet wide.

CROSS TIDES DAM.

No work was done on this dam. A recent survey shows that the crest of the southern half is about at mean low water, while the northern half is from 4 to 6 feet lower.

The strong ebb current has washed many of the smaller stones over the dam. Now, that the main works have been completed at Garden Bank and Wrecks Channel, I am of the opinion that the flow through Front River should be increased by bringing this dam up to high water.

GARDEN BANK SHOAL.

Two wing-dams, supplemented by dredging, were constructed in 1882 for the removal of this shoal, which is opposite the lower part of the city.

A third dam was built below these during the past season, and 5,953.52 cubic yards of material dredged.

The heads of the dams are 650 feet from the wharf lines opposite.

The shoal is now practically removed, the 9-foot curve has been pushed to the north about 300 feet, and the width of the channel along the dams, which is over 22 feet deep at mean high water, is now more than 200 feet. From present indications it is thought that the dams will maintain this favorable condition of the channel.

WRECKS CHANNEL.

A wing-dam was built just above the Fig Island training-wall, and the latter has been extended 1,000 feet, and eleven short spurs have been added along its southern side.

The width of channel measured from the spur heads to mean low water, of opposite bank, increases from 680 at the upper to 740 feet at the lower end. The latter is now in 15 feet of water, adjoining the deep pocket at Fort Jackson. Additional stone has been placed on the old work of the jetty to bring its crest to a uniform height of from 2 to 3 feet above mean low water; 77,183 cubic yards of sand and mud have been dredged from the channel.

Extensive shoaling has taken place north of the jetty and sand has rapidly filled in between the spurs, marsh grass begins to grow upon the work, and the formation of an artificial river bank is in progress. This may in time necessitate the raising of the jetty to prevent the sand from washing in from the north.

A comparison of the surveys of December, 1881, and May, 1883, shows much improvement at the upper end of the channel. A 15-foot curve is working its way along where but 12 feet was found before.

The channel width between the 12-foot curves has increased from 200 to 320 feet. Along the middle portion the 12-foot curve is more uniform and gives a wider channel. At the lower end a wider and more uniform channel exists.

There is still considerable movement of sand through the channel which is yet in the process of formation and will occasionally require the services of a dredge. It can be assisted by the raising of the Cross Tides Dam. The widening and increased regularity of the contours are favorable indications.

The channel is now wider, deeper, and more uniform than it has ever been.

CLOSING DAMS.

A closing dam, No. 5, has been built from the Carolina shore to the head of Barnwell Island, and another, No. 11½, from the south shore of the latter to the island (Barnwell No. 2) southeast of it. The object of these dams is to throw more water along the head of Elba Island.

HEAD OF ELBA ISLAND.

From the shoal at this point 29,084 cubic yards of material were removed and a dam, No. 15, built out from the small island (Barnwell No. 3) opposite, leaving a channel width of 1,000 feet.

UPPER FLATS CROSSING.

A set of four dams, Nos. 4, 6, 23, and 25, two on each side of the channel, have been built for the improvement of this crossing. No. 25 is not quite completed. The original width of the river, 1,500 to 3,000 feet, has been reduced to 1,000 to 1,100 feet between the heads of the dams.

No marked changes have yet been observed at the last two localities.

BIG GAP DAM.

Nine hundred and seventy cubic yards of stone have been deposited on this dam, bringing the crest up to 4½ feet above mean low water.

PHILBRICK'S CUT DAM.

This dam has been raised to 5 feet above mean low water by the deposit of 198 cubic yards of stone.

CABBAGE TREE CROSSING.

It is expected that the balance of the present appropriation will enable a set of four dams to be constructed at this crossing. Works will then have been erected for improving every shoal between the city and those at the mouth of the river.

The following maps, showing works, progress, soundings, &c., accompany this report:

1. Vicinity of Cross Tides Dam.
2. Garden Bank Shoal.
3. Wrecks Channel.
4. Barnwell Island to Dutch Gap.

The following tabular statements show the amount of work done during the past season up to June 30, 1883:

Locality.	Date when built.	Average depth in mean low water.	Length.	Mats.	Stone.
	1883.	*Feet.*	*Feet.*	*Square yards.*	*Cubic yards.*
Garden Bank No. 3	January ..	13	293	2,398.9	777.17
No. 1, above Fig Island jetty	January ..	9	185	1,555.4	393.56
Spur No. 1, Fig Island jetty	January ..	2	124	763.8	208.34
Spur No. 2, Fig Island jetty	January ..	2	110	668.8	241.71
Spur No. 3, Fig Island jetty	January ..	2	107	557.2	180.00
Spur No. 4, Fig Island jetty	January ..	2	134	657.2	121.27
Spur No. 5, Fig Island jetty	January ..	1	162	598.9	257.68
Spur No. 6, Fig Island jetty	January ..	1	153	565.5	161.58
Spur No. 7, Fig Island jetty	February .	1	129	482.2	110.00
Spur No. 8. Fig Island jetty	February .	1	148	548.8	226.84
Spur No. 9, Fig Island jetty	February .	1	173	882.1	185.00
Spur No. 10, Fig Island jetty	February .	3	191	882.1	243.17
Spur No. 11, Fig Island jetty	April	9	130	1,132.0	248.70
Extension of Fig Island jetty	April	10	1,000	13,232.3	2,454.23
Closing dam No. 11½	March	5	760	4,174.4	1,296.73
Closing dam No. 5	April	3	440	2,784.4	653.23
Wing-dam No. 15	March	9	900	5,111.8	1,261.87
Wing-dam No. 6	May	7	876	3,525.9	1,075.44
Wing-dam No. 4	May	8	380	8,382.8	1,727.92
Wing-dam No. 23	May	14	600	11,617.5	2,237.14
Wing-dam No. 25	June.....	11	2,087	13,026.1	2,544.81
Old work, Fig Island jetty	.....	.....	.....	121.6	1,856.37
Big Gap Dam	.....	.....	.....	.....	970.38
Philbrick's Dam	.....	.....	.....	.....	198.38
Total	.....	.....	.....	73,669.70	19,631.52

Material dredged.

From—	Date.	Quantity.
		Cubic yards.
Garden Bank Shoal	Dec., 1882–Jan., 1883	5,953.52
Upper end Wrecks Channel	April, 1883	8,460.50
Lower end Wrecks Channel	May–June, 1883	62,982.92
Head of Elba Island	Feb.–March, 1883	29,084.50
Wrecks Channel, by United States dredge-steamer H. Burden	Dec., 1882	5,740.00
Total	.....	112,221.44

Mr. T. H. Fisher, assistant engineer, has shown much industry in the discharge of his duties.

Very respectfully, your obedient servant,

THOS. N. BAILEY,
First Lieut., Corps of Engineers.

Col. Q. A. GILLMORE,
Corps of Engineers, U. S. A.

LETTER OF THE MAYOR OF SAVANNAH, GEORGIA.

MAYOR'S OFFICE, *June* 21, 1883.

DEAR SIR: In reply to your favor of 8th instant, I have the honor to inclose herewith the blanks as requested.

It will be observed that the duties collected during the year 1881 amount to $356,550.22, while for 1882 they amount to $61,148.70. This difference in favor of 1881 is accounted for by duties collected during said year on new steel rails for Waycross Railroad.

The work being done as well as that already accomplished under your direction, continues to prove of great benefit to this port.

Very respectfully yours,

RUFUS E. LESTER,
Mayor of Savannah, Ga.

General Q. A. GILLMORE, U. S. A.

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels at Savannah, Ga., from January 1, 1878, to December 31, 1882.

VESSELS ARRIVED.

Years.	Coastwise.			American vessels from foreign ports.			Foreign vessels from foreign ports.			Total.		
	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.
1878.....	322	385, 532	10, 688	61	45, 208	1, 576	326	235, 787	5, 814	709	666, 527	18, 078
1879.....	319	411, 794	8, 235	30	21, 994	439	279	198, 040	3, 960	628	631, 788	12, 634
1880.....	338	446, 881	9, 996	14	7, 724	170	244	172, 224	3, 533	596	626, 829	13, 699
1881.....	383	508, 422	11, 069	21	10, 729	237	254	151, 463	3, 474	658	670, 614	14, 780
1882.....	391	544, 448	12, 605	11	4, 865	106	204	115, 061	2, 718	606	664, 374	16, 429

VESSELS CLEARED.

1878.....	378	418, 958	10, 475	64	40, 128	1, 255	260	183, 757	5, 375	702	642, 843	17, 005
1879.....	365	442, 734	8, 834	36	24, 891	497	223	156, 470	3, 129	624	623, 095	12, 460
1880.....	310	434, 864	10, 108	26	12, 536	271	242	168, 255	3, 446	578	615, 655	13, 825
1881.....	369	508, 422	11, 458	22	13, 052	253	261	180, 579	3, 745	644	702, 053	15, 456
1882.....	350	506, 213	11, 917	23	9, 055	205	209	135, 375	3, 023	582	650, 643	15, 145

Years.	Value of exports.	Value of imports.	Duties collected.
1878	$24, 014, 625 00	$505, 596 00	$23, 364 35
1879	22, 556, 755 00	378, 782 00	27, 778 73
1880	26, 129, 896 00	660, 974 00	78, 458 41
1881. Foreign and coastwise	47, 448, 117 00	952, 512 00	356, 550 22
1882. Foreign and coastwise	48, 349, 033 00	657, 255 00	61, 148 70

Chief articles of export, port of Savannah, Ga.

Season.	Cotton, upland and sea island.	Naval stores.		Timber and lumber.	Yarns and domestics.	Wool.
		Resin.	Spirits turpentine.			
	Bales.	*Barrels.*	*Barrels.*	*Feet.*	*Bales.*	*Pounds.*
1877–'78	623, 293	177, 104	31, 138	69, 347, 047	27, 005	1, 088, 473
1878–'79	699, 726	177, 447	34, 368	70, 251, 720	32, 626	1, 155, 273
1879–'80	749, 008	234, 421	46, 321	71, 253, 025	42, 763	1, 291, 937
1880–'81	900, 000	290, 000	60, 000	71, 000, 000	45, 000	1, 450, 000
1881–'82	780, 000	310, 000	72, 450	75, 685, 000	51, 620	1, 386, 000
1882–'83	830, 498	370, 754	89, 144	78, 652, 000	48, 972	1, 475, 000

Season.	Hides undressed.	Fruit.		Vegetables.			Rice.
	Pounds.	*Barrels.*	*Boxes.*	*Barrels.*	*Boxes.*	*Carlds.*	*Casks.*
1877–'78	912, 486	1, 218	27, 445	3, 810	50, 621	66	.....
1878–'79	905, 199	2, 663	54, 334	2, 728	82, 030	79	31, 357
1879–'80	1, 076, 608	3, 959	99, 027	6, 219	166, 064	91	38, 754
1880–'81	1, 100, 000	4, 500	100, 000	7, 000	200, 000	150	40, 000
1881–'82	1, 076, 000	5, 200	104, 367	4, 900	215, 000	81	42, 980
1882–'83	1, 860, 000	5, 263	184, 079	6, 500	227, 800	92	39, 650

SPECIAL REPORT OF CAPTAIN JAMES C. POST, CORPS OF ENGINEERS, DATED DECEMBER 29, 1882.

[Called for by Senate resolution of December 21, 1882, and printed in Senate Ex. Doc. No. 51, Forty-seventh Congress, second session.]

The work of improving Savannah Harbor and the river of that name from the city to Tybee Roads is at present carried on under a project for permanently improving this portion of the river, submitted to the Chief of Engineers with Lieut. Col. Q. A. Gillmore's report of an examination of the river, dated January 16, 1882. It is designed by means of wing-dams and training-walls, aided by dredging, to increase the depth of the water in said river and harbor from the bar up to the city to 22 feet, and to widen the channel of the river opposite the city to 600 feet, and make it of uniform depth with the balance of the channel.

The project just referred to is an enlargement of two previous projects which were also prepared by Lieutenant-Colonel Gillmore, and which are dated August 28, 1873, and March 19, 1879, respectively.

The bulk of the work contemplated in the earliest project consisted in widening the water-way at the city front, and in deepening, widening, and straightening the channel by dredging at various points below the city to the vicinity of Tybee Roads. A dam at the Cross Tides, 4 miles above the city, and a short bulkhead on the Hutchinson's Island side, opposite the upper part of the city, also formed a part of the design.

The supplementary plan of improvement of March 19, 1879, had for its main object the improvement of the north channel of the Savannah River, in preference to the south channel, from the head of Elba Island to the head of Long Island.

The new features of this plan consisted in the construction of a low dam across the upper end of the south channel, inclosing by dams the lateral channels connecting the north and south channels from Elba Island to Cockspur Island, and in providing for shore protection.

In both of the two earlier projects it was anticipated that other works would be needed to secure a permanent improvement of the harbor of Savannah and its approach from the bar; and the latter project was designed to supply this deficiency.

The following is a summary statement of the progress made under the various projects referred to:

The dam at the Cross Tides is now built up to the height of about 3 feet above low-water level.

Two wing-dams have been constructed in Front River, opposite the lower part of the city, producing greater uniformity in the width of the channel by contracting the water-way. A third dam is being built.

A jetty or training-wall extends eastward from the lower end of Fig Island for a length of nearly a mile, rising from 2 to 3 feet above low water. It is designed to direct and retain the ebb currents in the new channel at "the Wrecks" throughout its length. Preparations are now nearly completed to extend this work still further east, and to add a number of short spurs for increasing its efficiency.

A low dam partially closes the upper end of the south channel, near the head of Elba Island.

Three high dams, of an aggregate length of 3,250 feet, now close the lateral passages between the islands; one at Philbrick's cut, another between Islands 1 and 2 and Bird Island, and a third between Bird and Long Islands.

A large amount of dredging, aggregating over 1,300,000 cubic yards, has been done at various points from the Cross Tides to near Tybee Roads since the first project of August 28, 1873, was adopted. By far

the greater portion of this was required to satisfy the immediate and pressing needs of navigation. Under the present project it is proposed, as far as practicable, to carry on the construction of works for permanent improvement of the river simultaneously with the dredging operations, so as to secure and hold the depths that will be obtained by the latter method.

At the close of the fiscal year ending June 30, 1882, the sum of $466,948.08 had been expended for this improvement. The appropriations up to that date aggregated $482,000, thus leaving a balance of $15,051.92, which was exhausted in the early part of the present fiscal year.

An appropriation of $200,000 was made for this work by act of Congress passed August 2, 1882. To expend this sum a contract was made with Mr. Eli T. Bangs, of Fayetteville, N. Y., for constructing wing-dams and training-walls in the Savannah River. Under the specifications he is required to furnish and put in the work from 120,000 to 140,000 square yards of log and brush mattresses and from 15,000 to 20,000 cubic yards of riprap stone. They also require him to complete at least $20,000 worth of work per month.

A contract for dredging about 200,000 cubic yards of material from the Savannah River was also awarded to Messrs. Dickerson and Paulsen, of Savannah, Ga. They agree to remove not less than 15,000 cubic yards per month.

Both contracts are now under way, and it is expected that only a small amount of the appropriation will remain unexpended at the close of the present fiscal year.

According to the enlarged project of January 16, 1882, further appropriations to the aggregate amount of $530,000 are required to complete the system of works of improvement contemplated from the city of Savannah to Tybee Roads.

It cannot be expected that a thorough and permanent improvement of the harbor and river of Savannah, with adequate depths in the navigable channel, can be effected unless all the deficient reaches of the river are improved by suitable works, as contemplated in the present project.

So long as a gap is left in the system the improvements made in the adjoining reaches will be of little avail, and should a suspension of operations be required from a want of funds there would undoubtedly be deterioration in those places partially improved, and the commercial advantages of the harbor seriously affected thereby, as well as the ultimate cost of the work increased. It is, therefore, very desirable and of great importance to have liberal appropriations for continuing the work energetically.

Without an additional appropriation all work will be suspended soon after July 1, 1883. Five hundred and thirty thousand dollars can be profitably expended during the fiscal year ending June 30, 1884, and at least $300,000 is necessary to conduct the work as it should be during that period.

L 7.

IMPROVEMENT OF SAVANNAH RIVER, GEORGIA, BETWEEN THE CITIES OF AUGUSTA AND SAVANNAH.

The river and harbor act passed August 2, 1882, appropriated the sum of $25,000 for "continuing the improvement between the cities of Augusta and Savannah, Ga." An appropriation of $15,000 had prev-

iously been made by act approved March 3, 1881, which was the first appropriation made by Congress for this work.

This portion of the Savannah River was examined under my direction in September and October, 1880. My report of this examination, with plan of improvement, dated December 22, 1880, is printed as Appendix J 6 of the Annual Report of the Chief of Engineers for 1881, and in House Ex. Doc. No. 23, Forty-sixth Congress, third session.

The distance between the cities of Augusta and Savannah is estimated at 108 miles in a straight line, and at 248 miles by river.

For a greater part of the year this portion of the river is navigable for steamboats drawing from 4 to 5 feet, but during the dry season in autumn the water is very low at various places, with depths of only 2 to 3 feet on some of the shoals, and boats had then to discharge and receive their cargoes at some point below Augusta.

The chief obstructions to navigation were found to be shoals or bars of sand, snags, floating and overhanging trees, and pile obstructions.

PROJECT OF IMPROVEMENT.

The project for improving the river, recommended in my report of December 22, 1880, comprises the following works:

1. Narrowing the river by low wing-dams where excessive widths produce or maintain shoals.
2. Aiding the accumulation of silt between the wing-dams by light hurdle traverses.
3. Protecting the banks, where needed, by thin, flexible brush mattresses, weighted with stone, or in some other suitable manner.
4. Cutting off some projecting points of land.
5. Removing existing pile obstructions.
6. Removing snags, floating timber, and overhanging trees.
7. Aiding the formation of the low-water channel in a few localities by dredging.

The object of the works here enumerated is to procure a low-river navigable depth of 5 feet, and their cost is estimated at $91,000.

OPERATIONS PRIOR TO JULY 1, 1882.

The first appropriation made for this work, amounting to $15,000, was almost entirely expended in constructing a suitable snag-boat to be used in removing snags, piles, trees, &c. The boat was completed in February, 1882, when she was put to work on the river about 180 miles above the city of Savannah, where she removed a number of the obstructions referred to.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1883.

Operations were carried on during the past fiscal year by means of the appropriation of $25,000 made by act passed August 2, 1882, together with the small balance on hand on July 1, 1882, amounting to $75.18.

The work done consisted in improving the reach of the river comprising Gardner's and Course's Bar, opposite to the lower part of the city of Augusta and extending down-stream for about 1½ miles. These shoals were considered to be the most serious obstructions to navigation during low-river stages.

The United States snag-boat was employed for about two months in removing snags, piles overhanging trees and wrecks of flat-boat.

The wing-dams constructed for improving the bars at and below the city of Augusta were built by contract. Proposals for doing this work were invited on October 13, 1882.

The dams as well as some bank protection were constructed as described in the specifications which formed part of the contract, and of which the following is an extract:

The dams will consist of brush made into fascines and loaded with stone. The fascines may, at the option of the engineer in charge, be laid one at a time or in mats, except where the water is over 4 feet deep, when they must be made into mats. When laid in shoal water the fascines will be fastened by stakes. There shall be, when stakes are used, at least 2 stakes for each fascine, or for each foot in length of mat. These stakes shall be at least 4 feet long for bottom layers and 6 feet long for the upper layers, should any be laid, and they must be driven until their heads are level with the brush.

When only one layer of fascines is laid, the covering of stone may be one foot thick at the tips and butts, and two feet at the middle of the dams, if required.

When more than one layer of fascines is used, the bottom layer shall be covered with stone or coarse gravel, six inches thick at the upper side and one foot thick at the lower side.

The amounts of stone to be placed on the several courses of mattresses as here specified, may be modified, subject to the directions of the engineer in charge.

On this stone or gravel a second layer of brush shall be laid, 5 or 8 feet (as may be required) further up stream than the lower layer, and this second layer shall be fastened and covered as the lower; and additional layers shall be similarly placed and covered, except that they shall be placed and laid each 2 feet further up stream than the one immediately below it, and the top layer covered with stone as described above where a single layer of brush is used.

At the junction of each dam with the shore there will be built 150 feet of shore protection 50 feet above and 100 feet below the center line of the dam.

These shore protections will consist of a layer of fascines or loose brush, as may be required, made into mats sunk at the foot of the slope of the bank, extending out into the river and up the slope as far as may be necessary, and riprap stone will be distributed over said mat in such a manner and in such quantity as will be designated by the engineer in charge.

Similar shore protections may also be required at other points of the banks, in the section of the river indicated in these specifications, and will be executed wherever required by the engineer in charge.

The bank will be trimmed to a regular slope, and all trees, stumps, &c., removed before the building of the shore protection, and no extra charge for such preparation of the bank will be allowed.

Fascines shall be made of live brush well trimmed and closely choked, 15 feet long and from 9 to 15 inches in diameter, and tied with four bands of tarred rope. When made into mats they will be closely packed and secured by at least three pairs of binding poles, joined by ties of tarred rope, not more than 2 feet apart.

Mats must be from 9 to 15 inches thick, and not less than 15 feet wide..

Stone to be of a kind that will not disintegrate upon exposure to the atmosphere or water. Its minimum size for top covering and shore protections to be 6 inches cubed, or an equivalent thereto, but when used between layers of brush it may be as small as coarse gravel, and not larger than 6 inches cubed, or its equivalent.

Stone and fascines are to be piled up in square piles, either on shore or on a boat, where they can be accurately measured.

Three bids were received, of which one made by Mr. J. E. Walter, of Savannah, Ga., proved to be the lowest. He offered to supply and put in the work, fascine mattresses, for $1.15 per cubic yard; and riprap stone for $2.45 per cubic yard. A contract was concluded with Mr. Walter on January 10, 1883.

Operations under the contract were carried on during the months from February to May 1883. During that time five wing-dams varying from 250 to 300 feet in length, and covering a length of river of about one-half a mile, were built for improving Gardner's and Course's bars. Opposite their heads, these dams reduce the width of the river, originally about 650 feet, to 350 feet at low water. Their shore ends rest on the South Carolina side of the river.

Opposite to the line of wing-dams the bluffy and caving banks on the Georgia side were strengthened at eight different places by suitable bank protections.

Course's Bar is designed to be improved by four wing-dams. Of these, one dam had been completed, and two others commenced, when the available funds were so far reduced that it was deemed advisable to suspend work.

Surveys made before beginning and after suspending operations show gratifying results. Four feet at low water can now be carried over the two bars and up to the city, where previously only from 2.4 to 3 feet of water existed. It is reported that the process of deepening still progresses.

No operations are contemplated during the present fiscal year, no funds having been provided for the work by Congress at its last session. It is proposed to apply the small balance on hand July 1, 1883, amounting to $1,112.15, to the removal of some of the most serious of the existing obstructions, with the United States snag-boat Toccoa.

Augusta is an important commercial town in the State of Georgia. Its population in 1880 was 23,023.

A large area of country is directly interested in securing greater depth in the navigable channel during low stages of the river from Augusta to tide-water.

It is recommended that an early and liberal appropriation should be made by Congress for this work.

This improvement is located in the collection district of Savannah, Ga. Savannah is the nearest port of entry. Amount of duties collected in 1882, $61,148.70.

The report of Lieut. T. N. Bailey, Corps of Engineers, and a plan showing works of improvement executed on Gardner's Bar, are transmitted herewith.

Money statement.

July 1, 1882, amount available		$75 18
Amount appropriated by act passed August 2, 1882		25,000 00
		25,075 18
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$17,660 18	
July 1, 1883, outstanding liabilities	6,302 85	
		23,963 03
July 1, 1883, amount available		1,112 15
Amount (estimated) required for completion of existing project		51,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		51,000 00

Abstract of proposals for constructing wing-dams in the Savannah River below the city of Augusta, Ga., opened November 14, 1882.

No.	Names and addresses of bidders.	Fascines.	Stone.
		Per cu. yd.	*Per cu. yd.*
1	Robert S. Burnett, Savannah, Ga	$1 33	$2 37
2	Bondurant and Jopling, Augusta, Ga	5 50	7 50
3	James E. Walter, Savannah, Ga	1 15	2 45

Contract awarded to James E. Walter; dated January 10, 1883; to commence January 30, 1883; to complete July 15, 1883.

Savannah River, at Augusta, Ga.

showing work recently constructed
under the direction of

Col. Q. A. Gillmore, Corps of Engrs. Bvt. Maj. Gen. U.S.A.

Lieut. Thos. N. Bailey, Corps of Engrs. U.S.A. in local charge.

W. R. Curtis, Asst. Engr.

Accompanying Annual Report of July 30th 1883,
for the fiscal year ending June 30. 1883.

Q. A. Gillmore
Col. Engrs. Bvt. Maj. Gen. U.S.A.

Mag. Mer.

The soundings are expressed in feet and tenths and reduced to Mean Low Water.
The soundings placed within brackets ( ) were taken May 5. 1883. The others were taken Febr. 8, 1883.
The 3 feet curve is marked ----------
" 4.5 " " " " ----.----.----
Both of these curves refer to survey of Febr. 8. 1883.
Soundings marked thus: 3.6, 4.5 were taken June 22. 1883.

HAMBURG

South Carolina R.R. Bridge

Toll Bridge

Gauge

Built in March 1883

Built in April 1883

Built in April 1883

Built in May 1883

S.P.

Shore protection

CITY OF AUGUSTA

Crosssection of Wingdam

Scale

6 4 2 0 5 10 15 feet.

Low water

Soft shifting sand

Scale of Chart

100 0 200 400 600 800 1000 feet

REPORT OF LIEUTENANT THOMAS N. BAILEY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., July 1, 1883.

COLONEL: I have the honor to submit the following report of operations during the past fiscal year for "Improving Savannah River, Georgia, between Augusta and Savannah."

The work has consisted in improving the channel over Gardner's and Course's bars. near Augusta, and in the employment of the snag-boat Toccoa on the river below.

GARDNER'S BAR.

This bar, opposite the lower part of the city of Augusta, is composed of fine sand, and extends about 2,000 feet below the Augusta Toll Bridge.

Average width of the river at this point is 650 feet. The plan of improvement, as indicated in your report of December 22, 1880, has been to reduce the low-water width of the river to 350 feet, by wing-dams extending from the Carolina bank, in directions perpendicular to the current.

The dams are low, and present little obstruction to the river at high stages.

Mattresses composed of brush fascines, 1 by 15 feet, confined by three pairs of binding poles, were first sunk along the bank, at the water's edge to protect the shore ends of the dams.

The protection was extended to 6 feet above the water by using loose fascines secured by stakes and a covering of stone. This protection extends 30 feet above and 60 feet below the axis of the dam. Mattresses similar to the above were used in constructing the dams. The lower course extends about 40 feet beyond the finished crest of the dam, and is loaded with 6 inches of stone. The second course was placed 8 feet further up stream, and when additional courses were necessary they were sunk 2 feet above the preceding ones.

These mats received 3 inches of stone on the up-stream side, and 15 inches on the lower side, except the top course, on which the crest was formed, about 6 feet above its lower edge. Five dams were built, from February 21, to May 16, 1883, as follows:

No. of dam.	Distance apart.	Length.	Average depth.	Fascines.	Stone.
	Feet.	*Feet.*	*Feet.*	*Cubic yds.*	*Cubic yds.*
2	.....	300	7.5	653.49	581.66
3	520	270	6.5	656.63	545.96
4	620	260	7.0	615.10	486.63
5	590	250	6.0	559.50	490.47
6	710	260	3.0	360.80	382.13

The Georgia bank, below Gardner's Bar, is high and abrupt, and has been caving for many years at an average rate of 1.5 feet annually.

Eight prominent points of this bank have received shore protection, aggregating 1,375 linear feet, and inclosing 3,200 feet of the bank.

COURSE'S BAR.

This bar, over which the channel crosses the river, is 1 mile below Gardner's Bar. Of four dams projected for the improvement of this crossing, one was completed and the foundation of two others laid, when work was suspended June 22, 1883.

Up to the latter date an aggregate of 5,398.81 cubic yards of fascines and 4,677.12 cubic yards of stone had been placed.

A survey of these two bars was made in February, 1883, before the dams were built. A reading of 4.4 on the Augusta bridge gauge was found to correspond to mean summer low water. This survey gave a low-water depth of 2.4 feet on Gardner's Bar and 3.0 on Course's. Soundings taken during the progress of the work, and recent ones, show very favorable results. Four feet at low water can now be carried over Course's Bar, Gardner's Bar, and up to the city wharves; this was the end sought by the construction of the dams, and was not possible before they were built. The low-water channel depth is still increasing.

A map of the works accompanies this report.

To the practical ability and energetic supervision of Mr. W. R. Curtis, assistant engineer, the success of the improvement is largely due.

Between November 15, 1882, and March 14, 1883, the United States snag-boat Toccoa operated for about two months on the river above Savannah. The principal points where work was done were Hudson's Landing, King Creek, and at the obstructions 187 miles above Savannah. Ninety-four snags, thirty-two piles, one hundred and sixteen leaning trees and a number of wrecked flats were removed.

Very respectfully, your obedient servant,

THOS. N. BAILEY,
First Lieutenant of Engineers.

Col. Q. A. GILLMORE,
Corps of Engineers, U. S. A.

SPECIAL REPORT OF CAPTAIN JAMES C. POST, CORPS OF ENGINEERS, DATED DECEMBER 29, 1882.

[Called for by Senate resolution of December 21, 1882, and printed in Senate Ex. Doc. No. 51, Forty-seventh Congress, second session.]

For the greater portion of the year, boats of from 4 to 5 feet draught can pass from Savannah to Augusta, a distance of 248 miles, but during low-river season there are shoals obstructing navigation, having from 2 to 3 feet of water above them. Besides these shoals or sand bars, which generally occur in the wide reaches, there are many snags and overhanging and floating trees which seriously impede the passage of vessels.

According to the project of improvement, submitted to the Chief of Engineers with the report of Lieut. Col. Q. A. Gillmore, Corps of Engineers, dated December 22, 1880, it is proposed to narrow the river by wing-dams where necessary, aiding the deposit of silt by light dikes where desirable, revetting caving banks, cutting away projecting points, removing snags, &c., and dredging where it may be deemed necessary to assist the formation of a low-water channel.

The cost of improving the river between the cities of Augusta and Savannah, so as to establish a permanent low-water channel not less than 5 feet deep, is estimated at $91,000.

The sum of $15,000 having been appropriated by the act approved March 3, 1881, for the purpose of starting this improvement, it was deemed best to commence operations by constructing a suitable snag-boat to be used in removing from the river obstructing snags, piles, trees, &c. The cost of this boat exceeded the appropriation, but as it was intended to use it for similar purposes on the tidal section of the river below the city of Savannah, as well as in improving Altamaha River, Georgia, a portion of its cost was charged to these improvements and a small balance of the appropriation could be employed for actual operations.

During the early spring of 1882 the snag-boat removed a number of piles, snags, and overhanging trees at various points of the river, from 70 to 130 miles below the city of Augusta, until the available funds were exhausted.

Comparatively but little actual work was, therefore, done on the river, and no results of material consequence toward bettering its condition were attained.

Another appropriation, amounting to $25,000, having been made by act of Congress passed August 2, 1882, measures were taken to resume the work of improvement. The snag-boat was again put into commission, but the largest part of the appropriation will be expended in improving by a number of wing-dams the worst shoals, known as Gardner's and Course's Shoals, immediately below Augusta. A contract for build-

ing these dams has been awarded to Mr. J. E. Walter, of Savannah, Ga. It is believed that the appropriation will be exhausted during the present fiscal year.

The sum of $51,000 is required for completing the existing project, and can be profitably expended during the fiscal year ending June 30, 1884. It would be an advantage if the whole amount required were appropriated during the present session of Congress to insure more favorable proposals from contractors.

Colonel Gillmore refers in his report of December 22, 1880, to the probability that supplementary works may yet be needed not comprised in the estimates of the present project, because the river is not naturally fixed in its bed. This will probably cause new difficulties, and obstructions may be developed at other points; although it is impossible now to say how soon and at what points it may become necessary to undertake these additional improvements.

In regard to the question whether a suspension of work on this section of the Savannah River would be detrimental to the public interests, it may be said that the end in view in designing the project, which was to establish a practicable low-water channel of adequate depth between Augusta and Savannah, cannot be secured unless all the works contemplated in the plan are constructed and all the obstructions in the channel-way removed. Improvements effected in detached portions of the river will be of little or no benefit to commerce and navigation as long as reaches of deficient depth remain between them.

Fifty-one thousand dollars can be profitably expended during the year ending June 30, 1884; the same amount is necessary to conduct the work properly during that period.

L 8.

IMPROVEMENT OF SAVANNAH RIVER ABOVE AUGUSTA, GEORGIA.

By act of Congress passed August 2, 1882, the sum of $15,000 was appropriated to continue the improvement of Savannah River *about* Augusta, Ga. Two appropriations, aggregating $24,000, had previously been made for this work, which is designed to improve the section of river between Trotter's Shoal and Augusta, a distance of 64 miles.

The Savannah River was examined under my direction, from Augusta up to the head of pole-boat navigation, a length of 154 miles, in November and December, 1878. The report thereon is printed in Appendix I 2, Annual Report of the Chief of Engineers for 1879.

I stated in that report that, until a thorough examination could be made above Trotter's Shoal, any money that might be appropriated should be expended upon that portion of the river below that shoal.

Two estimates were submitted, viz:

1. Cost of improving the river for pole-boat channel, 3 by 30 feet, from Augusta to Trotter's Shoal, 64 miles $45,000
2. Cost of steamboat channel, 3 by 90 feet, same route 124,000

Operations have been carried on in conformity to the first-named project.

WORK DONE PRIOR TO JULY 1, 1882.

Operations first began in June, 1881. The river was improved at a number of places between the city of Augusta and Trotter's Shoal, but the bulk of the work was done at Little Rapid Gap, Stevens's Creek Falls, and Big Rapid Gap, all within 8 miles of the city.

During the period named, 3,490 cubic yards of rock were removed, chiefly by blasting; 62 cubic yards of gravel and 37 cubic yards of loose rock were excavated, and 2,458 cubic yards of broken rock were employed in constructing wing-dams for contracting the channel.

OPERATIONS DURING THE FISCAL YEAR JUST CLOSED.

The work of last fiscal year was done by means of the appropriation of $15,000, made by act of Congress passed August 2, 1882.

Proposals were invited on November 18, 1882, for continuing the improvement from Augusta Canal Lock to Barksdale Ferry, about 50 miles above Augusta, by straightening and widening the channel through the rock ledges and removing the sunken rocks by raising the existing wing-dams and building new dams, composed of brush mattresses overlaid with stone, and by removing gravel where needed. Mr. W. H. Browne, of Brooklyn, N. Y., was the lowest bidder, and a contract was made with him on January 5, 1883.

Operations under this contract commenced in April last, and were nearly completed on June 30, 1883. They extended from Stevens Creek Ledge, 8½ miles above Augusta, to Ring Jaw, 34 miles above the city.

The old channels were deepened and widened by removing bowlders and portions of rock ledges, by removing sand and building wing-dams at "The Reach," 10 miles above Augusta, and a new channel was cut through the ledge above Stevens Creek Falls, which enables pole-boats to avoid the passage at the latter place and at "Rapid Gap."

During the past season, to June 30, 1883, 439 cubic yards of rock were excavated, and 6,669.88 square yards of brush mattresses of about 18 inches thickness, and 1,726 cubic yards of stone were employed in the construction of wing-dams.

The work has resulted in producing a practicable channel of 20 feet width, and 2½ feet depth at summer low water, from Augusta Canal Lock to Barksdale Ferry. At several places of this reach there was formerly only from 1 foot to 2 feet of water over the shoals.

Work under the existing contract will be completed during the first week of the present fiscal year.

As to the amount of commerce and navigation to be benefited by completing this improvement, I beg leave to refer to my report of February 8, 1879, printed in House Ex. Doc., No. 90, Forty-fifth Congress, third session, and in Appendix I 2, Annual Report of the Chief of Engineers for 1879. I have received no additional data since that time.

This work is located in the collection district of Savannah, Ga. Savannah is the nearest port of entry. Amount of duties collected in 1882, $61,148.70.

Since the works of improvement were commenced, the following appropriations have been made:

By act of Congress, approved June 14, 1880	$16,000
By act of Congress, approved March 3, 1881	8,000
By act of Congress, passed August 2, 1882	15,000
Total	39,000

Of this amount there has been expended from the beginning of operations to June 30, 1883, the sum of $36,604.41, including outstanding liabilities.

The estimated cost of the existing project being $45,000, a further appropriation of $6,000 will be required to complete the work.

The report of Lieut. T. N. Bailey, Corps of Engineers, is appended.

Money statement.

July 1, 1882, amount available		$247 24
Amount appropriated by act passed August 2, 1882		15,000 00
		15,247 24
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$8,471 53	
July 1, 1883, outstanding liabilities	4,380 12	
		12,851 65
July 1, 1883, amount available		2,395 59
Amount (estimated) required for completion of existing project		6,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		6,000 00

Abstract of proposals for removing rock and other obstructions, and building wing-dam in the Savannah River, above Augusta, Ga., opened December 9, 1882.

No.	Names and addresses of bidders.	Removing rock.	Removing gravel.	Furnishing and putting in mattresses.	Furnishing and putting in stone.
		Per cu. yd.	*Per cu. yd.*	*Per sq. yd.*	*Per cu. yd.*
1	William H. Browne, Brooklyn, N. Y.	$4 32	$0 31	$0 92½	$2 31½
2	Frank Blaisdell, Augusta, Ga	4 50	0 35	0 85	2 75

Contract awarded to William H. Browne; dated January 5, 1883; to commence February 1, 1883; to complete June 30, 1883.

REPORT OF LIEUTENANT THOMAS N. BAILEY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., July 12, 1883.

COLONEL: I have the honor to submit the following report of operations during the past fiscal year for "improving Savannah River about Augusta."

The work which began April 17, and was completed July 7, 1883, has consisted in deepening and widening old channels by the removal of bowlders and portions of ledges, and in the construction of a number of short dams in "The Reach" 10 miles above Augusta, to clear the channel of sand.

The object has been to secure a channel 20 feet wide and 30 inches deep at summer low water, from the canal locks, 7 miles above Augusta to Barksdale Ferry, 50 miles above that city. The sand has been cleared from the channel at "The Reach" except for a distance of about 400 feet; it is gradually disappearing from the latter stretch. The old channel through "Rapid Gap" being badly obstructed by sand, a cut was made through the ledge above the Falls. Boats now use this route and thus avoid "Rapid Gap" and "Stevens Creek Falls."

The following is a table of the principal points where work was done :

	Miles above Augusta.
Stevens Creek Ledge	8.5
Lower Ledge	9.5
Picken's Ledge	10.0
The Reach	10.5
Pine Log	11.5
Scott's Shoal	21.0
Chicken Sluice	21.5
Little River	24.5
Elbow	29.5
Ring Jaw	34.0

Amount of work done.

1883.	Mattresses.	Stone.	Rock excavation.
	Square yards.	*Cubic yards.*	*Cubic yards.*
April	1, 316. 64	333. 56	20. 00
May	4, 386. 57	1, 010. 17	22. 00
June	966. 67	382. 26	397. 01
July	.....	.....	302. 00
Total	6, 669. 88	1, 725. 99	741. 01

I forward with this report a map of the river showing the localities where work has been done.

Mr. W. R. Curtis, assistant engineer, who was charged also with the improvements at Augusta, performed his duties with his usual practical ability.

Very respectfully, your obedient servant,

THOS. N. BAILEY,
First Lieut., Corps of Engineers.

Col. Q. A. GILLMORE,
Corps of Engineers, U. S. A.

SPECIAL REPORT OF CAPTAIN JAMES C. POST, CORPS OF ENGINEERS, DATED DECEMBER 29, 1882.

[Called for by Senate resolution of December 21, 1882, and printed in Senate Ex. Doc. No. 51, Forty-seventh Congress, second session,]

The Savannah River, from the city of Augusta to the head of pole-boat navigation, near Tallulak Falls 154 miles above Augusta, was examined in November and December, 1878, under direction of Lieut. Col. Q. A. Gillmore, Corps of Engineers, whose report thereon, dated February 8, 1879, is printed in Appendix I 2, Annual Report of the Chief of Engineers.

The obstacles to navigation on the route indicated are reported to be numerous, extensive, and not unfrequently dangerous. They consist chiefly of rocky ledges running across the channels, isolated bowlders, and shoals of gravel.

Colonel Gillmore recommended that until a thorough examination could be made above Trotter's Shoal, 64 miles from Augusta, any money that might be appropriated should be expended upon that portion of the river below that shoal, and submitted two estimates to that end, viz:

1. Cost of improving the river for pole-boat navigation, giving a channel 3 feet by 30 feet, from Augusta to Trotter's Shoal $45, 000
2. Cost of steamboat channel, 3 feet by 90 feet, on the same route 124, 000

Operations have been carried on in conformity to the first plan, and by means of two appropriations aggregating $24,000. Numerous places of the route described were improved either by the construction of wing-dams for confining the currents in fixed channels, or by removing rock and gravel from ledges and shoals. There have been thus far removed 3,527 cubic yards of rock, chiefly by blasting, and 62 cubic yards of gravel; while 2,458 cubic yards of stone were employed in the construction of wing-dams.

On July 1, 1882, a balance of $247.24 remained on hand unexpended.

By the act of Congress passed August 2, 1882, an appropriation of $15,000 was made for this improvement. It is proposed to expend this sum in continuing the work recently commenced, of straightening and widening the channel through the ledges and removing the sunken

rocks. Existing wing-dams will be raised higher and new dams built where it will be deemed necessary. For that purpose a contract has recently been awarded to Mr. William H. Browne, of Brooklyn, N. Y., and operations will soon be commenced. It is expected that the appropriation will be exhausted during the present fiscal year.

Examinations have shown that the efforts thus far made for improving the river channel for pole-boats have undoubtedly produced favorable results. It may be considered questionable, however, whether it is expedient to incur further expenditures on the part of the Government for the benefit of this kind of navigation. The growing competition of railroads, running more or less parallel to and in the vicinity of this part of the Savannah River, is detrimental to the development of transportation by pole-boats, which are limited in carrying capacity and comparatively slow and uncertain in the transit of their cargoes.

There is also great danger that the continued straightening of the river and the increase of the water-way through the ledges of rocks may add to the strength of the river current to such a degree that the difficulties for boats passing up the river will be greatly augmented, and thus the further expenditure of money become a detriment rather than a benefit to navigation.

In view of these facts, it is not considered expedient to ask for any additional appropriation for this work at the present time.

L 9.

IMPROVEMENT OF ROMERLY MARSH, GEORGIA.

By the river and harbor act passed August 2, 1882, the sum of $10,000 was appropriated for the improvement of Romerly Marsh, Georgia, "by route designated in the survey of engineers as route numbered four." This is the first appropriation made by Congress for this work.

An examination of Romerly Marsh had been provided for by section 2, of the act approved June 14, 1880, and was made under my direction in the latter part of 1880. My report of this examination, describing four different routes that might be selected, with estimates of cost, and dated November 15, 1880, is printed as Appendix J 19 of the Annual Report of the Chief of Engineers for 1881, and in House Ex. Doc. No. 19, Forty-sixth Congress, third session.

The water route through Romerly Marsh forms a part of the inland passage between the Savannah River, Georgia, and the Saint John's River, Florida. Romerly Marsh is situated to the southeast of Skidaway Island, between Wassaw Sound on the north and Ossabaw Sound on the south.

Route No. 4, which was named in the act as required to be adopted, is the most easterly one of those that were examined. By this route the northerly creek known as Dead Man's Hammock Creek, which flows through the marsh and empties into Wassaw Sound at the mouth of Romerly Marsh Creek, is to be connected by a cut with Wassaw Creek, which flows into Odingsell River not far from the point where the latter empties into Ossabaw Sound.

PROJECT OF IMPROVEMENT.

In order to provide for a more convenient passage for steamboats in place of the existing route which is exceedingly crooked, with sharp bends and insufficient low-water depths, I proposed in my report of

November 15, 1880, that either one of the four routes described therein that might be adopted for improvement should receive a depth of not less than 7 feet at low water, with a bottom width of 48 feet, and side slopes of 1 height to 3 base. The cost of establishing route No. 4, selected by Congress, was estimated at $38,720.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1883.

The sum of $10,000 appropriated by Congress was deemed to be too small to open a cut through the marsh wide enough for steamboats. I therefore recommended to postpone work until another appropriation should be made, which was approved by the Chief of Engineers.

In January, 1883, the Georgia and Florida Steamboat Company offered to deposit the sum of $5,000 to the credit of Capt. J. C. Post, Corps of Engineers, who had temporarily relieved me of my duties during my sickness, said sum to be added to the Government appropriation for the purpose of commencing the work, with the proviso that if Congress during its "present session" should make an appropriation of not less than $3,000, the amount supplied by the parties named should be returned to them. By this arrangement the sum of $15,000 would become available, which was then thought to be sufficient to open a cut of ample width and depth through the marsh for the accommodation of vessels used on the Inside Passage.

On recommendation of Captain Post the acceptance of the offer of $5,000 made by the steamboat company was approved by the Department.

On February 8, 1883, advertisements calling for proposals for dredging in Romerly Marsh were published. Three bids were received, one of them being informal; of the others, the bid made by Dickerson and Paulsen, of Savannah, Ga., was lowest. They offered to do the work at the price of 18 cents per cubic yard. With the approval of the Department, a contract was entered into with them on March 28, 1883.

Operations were commenced on May 7, 1883. At the end of the past fiscal year 12,718 cubic yards of material had been removed, with a linear progress in the cut of 252 feet. The total length of the cut will be about 3,470 feet. As far as made, the cut has a low-water depth of 7 feet, equivalent to a total depth of excavation of about 15 feet, the surface of the marsh in the vicinity of route No. 4 being about 8 feet above the level of low water. The width of the cut is 50 feet at the bottom and 110 feet on the marsh.

OPERATIONS CONTEMPLATED DURING THE PRESENT FISCAL YEAR.

With the balance on hand July 1, 1883, amounting to $7,539.07, the cut recently commenced will be further extended.

It is not possible with the funds still available to finish the cut from end to end, with the cross-section adopted, and it is doubtful whether it will be practicable to make a through cut of reduced dimensions, but wide and deep enough for steamboats at a stage of tide several feet above the level of mean low water. This result is partly due to the inadequacy of the funds provided and partly to the fact that the cut must be made of greater depth than originally estimated for. Assistant Engineer S. L. Fremont, who was in immediate charge of the examination of Romerly Marsh, made under my direction in 1880, estimated that the surface of the marsh at the sites of the several routes examined was about 5 feet above the level of low water. In finally locating

route No. 4, and examining its site preliminary to beginning operations during the present fiscal year, the surface of the marsh was found to be about 8 feet above low water, and the route, moreover, was traversed on part of its length by a still higher and partly timbered hummock.

When the present funds are exhausted, the new route will therefore, probably, not be open for steamboats, and another appropriation is needed to complete the project, or at least to open a passage with temporarily reduced cross-section.

I have no late information relative to the amount of commerce and navigation that would be benefited by completing the existing project. The importance of the Inland Passage between Savannah, Ga., and Jacksonville, Fla., of which the Romerly Marsh route forms a part, was briefly pointed out in my report of November 15, 1880.

This report is accompanied by a chart showing location of route No. 4 and progress made to June 30, 1883, and by the report of Lieut. T. N. Bailey, Corps of Engineers.

The improvement is located in the collection district of Savannah, Ga. Savannah is the nearest port of entry. Amount of duties collected in 1882, $61,148.70.

Money statement.

Amount appropriated by act passed August 2, 1882		$10,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$61 63	
July 1, 1883, outstanding liabilities	2,399 33	
		2,460 96
July 1, 1883, amount available		7,539 04
Amount (estimated) required for completion of existing project		24,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		24,000 00

Abstract of proposals for dredging in Romerly Marsh, Georgia, opened February 26, 1883.

No.	Names and addresses of bidders.	Price.
		Per cu. yd.
1	James E. Walter, Savannah, Ga	$0 22½
2	E. H. Haight & Co., Jersey City, N. J.*	.....
3	Dickerson & Paulsen, Savannah, Ga	18

* Proposal informal.

Contract awarded to Dickerson & Paulsen; dated March 28, 1883; to commence April 15, 1883; to complete August 1, 1883.

REPORT OF LIEUTENANT THOMAS N. BAILEY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., July 3, 1883.

COLONEL: I have the honor to submit the following report of operations during the past fiscal year for "Improvement of Romerly Marsh, Georgia."

The contractors, Messrs. Dickerson & Paulsen, of Savannah, began dredging May 7, 1883; up to June 30, 1883, the cut had progressed 84 yards, and 12,718.5 cubic yards of material had been removed.

A dredge cut, 25 feet wide and 15 feet deep, has been made each side of the center line. The resulting cross-section measures about 110 feet on the marsh, 50 feet at the bottom and 78 feet by 7 feet deep at mean low water. The material is marsh mud

for about 3 feet, overlaying a marly, bluish mud mixed with sand and small shells; it assumes a slope of 1 on 2. The length of the proposed cut, which is "Route No. 4" of your report of November 15, 1880, is 1,156 yards.

The surface of the marsh is practically level and 8 feet above mean low water.

I estimate that the entire cut will require the removal of 157,529 cubic yards of material at a cost, present prices, of $31,190.

A map of the locality, showing progress, accompanies this report.

Very respectfully, your obedient servant,

THOS. N. BAILEY,
First Lieut. of Engineers.

Col. Q. A. GILLMORE,
Corps of Engineers, U. S. A.

SPECIAL REPORT OF CAPTAIN JAMES C. POST, CORPS OF ENGINEERS, DATED DECEMBER 29, 1882.

[Called for by Senate resolution of December 21, 1882, and printed in Senate Ex. Doc. No. 51, Forty-seventh Congress, second session.]

By act of Congress passed August 2, 1882, the sum of $10,000 was appropriated for "the improvement of Romerly Marsh, by route designated in the survey of engineers as route numbered 4." This is the first appropriation ever made for this work.

The water route through Romerly Marsh forms a part of the inland passage between the Savannah River, Georgia, and the Saint John's River, Florida. Romerly Marsh is situated to the southeast of Skidaway Island, between Wassaw and Ossabaw sounds.

The survey referred to in the act was made under the direction of Lieut. Col. Q. A. Gillmore, Corps of Engineers, whose report to the Chief of Engineers, with projects and estimates of cost, dated November 15, 1880, was printed in House Ex. Doc. No. 19, Forty-sixth Congress, third session.

The survey was made for the purpose of selecting a more suitable route for steamboats through the marsh, in place of the existing one, which is exceedingly crooked, with sharp bends and insufficient low-water depths. Vessels drawing 5 feet of water cannot pass through on less than half-tide.

Colonel Gillmore describes in his report four different lines which were considered as feasible and were consequently examined. The estimates of the cost of establishing these routes were made on the basis of making the required cuts through the marsh 48 feet wide at the bottom, with side slopes of 1 to 3, and with a low-water depth of 7 feet.

Route No. 4, designated in the act as the line to be adopted, is the most easterly one of those examined. By this route the northerly creek, flowing through the marsh and emptying into Wassaw Sound at the mouth of Romerly Marsh Creek, is to be connected by a cut with Wassaw Creek, which flows into Odingsell River not far from the point where the latter discharges into Ossabaw Sound.

The cost of establishing route No. 4 is estimated at $38,720.

This improvement has not yet been commenced. The sum of $10,000 was considered too small to open a cut through the marsh wide enough for the passage of steamboats, and Colonel Gillmore therefore recommended to postpone work until another appropriation would be made; which recommendation was approved by the Chief of Engineers.

Subsequently the Georgia and Florida Inland Steamboat Company offered to subscribe $10,000, to be added to the Government appropriation of $10,000, in order to insure the commencement of the work of improving Romerly Marsh at an early date. This offer was received fa-

CHART OF A PORTION OF

ROMERLY MARSH, GA.

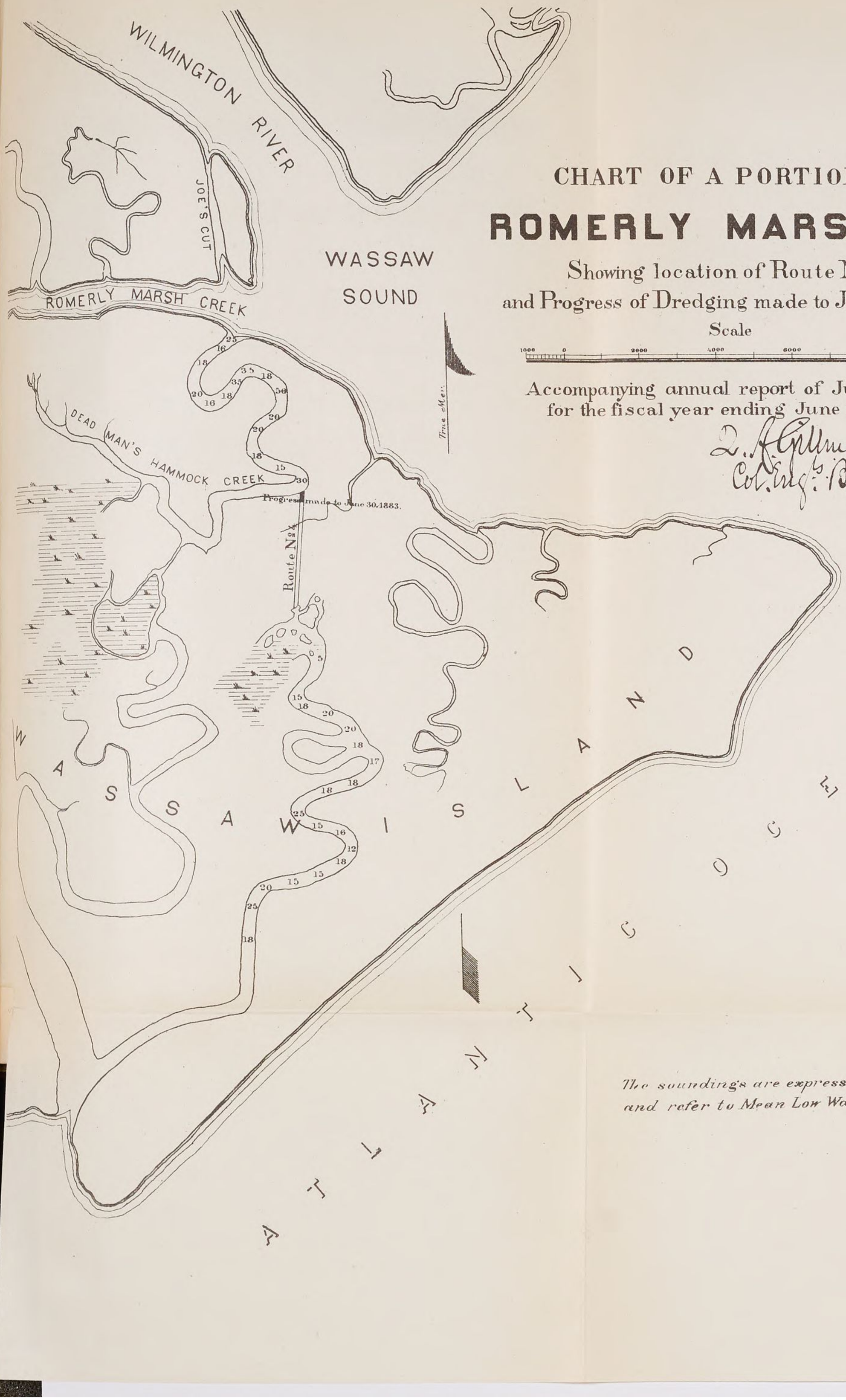
Showing location of Route Nº 4
and Progress of Dredging made to June 30.1883.

Scale

1000 0 2000 4000 6000 8000 12,000 ft.

Accompanying annual report of July 20th 1883,
for the fiscal year ending June 30.1883.

D. A. Gillmore
Col. Engrs. Bvt. Maj. Gen. U.S.A.



The soundings are expressed in feet and refer to Mean Low Water.

vorably by the Department, and authority was given to invite proposals for doing the work by contract as soon as the funds thus offered should be placed at the disposal of the Government. This, however, has not been done, and the matter remains in abeyance.

In case that the sum of $10,000 offered by the parties referred to should be received, bids will be invited to have that amount, together with the appropriation of August 2, 1882, expended in dredging, and it is possible that the aggregate sum of $20,000 thus obtained will be exhausted during the present fiscal year. As there is considerable doubt existing as to whether this money will be advanced, it is regarded best, in considering the amount required for this work during the next fiscal year, to ignore the offer.

The appropriation of the balance of the estimate for this work, $28,720, is therefore recommended. It can be profitably expended during the fiscal year ending June 30, 1884, and is necessary to conduct the work properly.

L 10.

IMPROVEMENT OF BRUNSWICK HARBOR, GEORGIA.

During the fiscal year ending June 30, 1883, operations were carried on in conformity to the project suggested in my report of April 29, 1876. Subsequently modified as described in my annual report of 1880.

Previous to the beginning of operations under the approved project, an appropriation of $10,000 was made by Congress in 1836 and expended for removing a shoal in the same locality where improvements are now being made.

PROJECT OF IMPROVEMENT.

The project provides for the construction of a jetty projecting from the most easterly point of Buzzard's Island, located approximately parallel to and about 1,000 feet distant from the opposite shore, for the purpose of contracting the water-way and concentrating the currents; also for more or less dredging where it is necessary to aid the action of the currents in deepening the channel.

The object of these operations is to establish and maintain a ship-channel of 15 feet depth at mean low water through the shoal situated about 1 mile below the city of Brunswick, where heretofore there existed a low-water depth of only 9 feet.

The cost of this project is estimated at $73,187.50.

In the existing project no estimates were included for works at the upper end of Buzzard's Island or elsewhere that might eventually be needed for increasing the ebb-flow in Brunswick River (East River). These matters were held in abeyance for future consideration.

The mean rise and fall of tides at Brunswick Harbor is about 7 feet.

OPERATIONS PRIOR TO JULY 1, 1882.

From the beginning of operations under the existing project to June 30, 1882, the following work was done: On that date the main line of the jetty had reached a length of 1,794 feet, measured from the angle of junction with a return face connecting it with the east shore of Buzzard's Island.

The first length of 780 linear feet of the main line is formed by pal-

metto cribs filled with brush and dredged material and topped off with riprap stone; their crest is a few feet below low water. The outer end of the work, for a length of 1,014 linear feet, is composed of double-raft mattresses covered with riprap stone; their aggregate thickness through logs and stone is about 4 feet.

The jetty, for a length of 650 feet, beginning at the angle of junction with the return face, was laid on a range bearing south 14 degrees 30 minutes east, the balance on a range bearing south 12 degrees east.

The return face, measuring 310 linear feet, consists of a line of cribs similar to those of the main line.

A brief description of the cribs and double-raft mattresses employed was given in my annual reports of 1881 and 1882, respectively.

During the period named above, 52,018 cubic yards of material was removed by dredging on a line parallel to the jetty and about 240 yards east of it. The dredging was executed on four lines of cutting adjoining each other, each from 20 to 25 feet in width. Two of the lines extended to the shoal opposite Brandy Point; they were dredged to a low-water depth of 15 feet. The other two cuts were not carried so far down stream and were dredged to a depth of 12 feet only. All these cuts commenced a little above the angle of junction of the jetty with the return face.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1883.

During the last fiscal year work was carried on by means of the appropriation of $25,000 made by act of Congress passed August 2, 1882.

The jetty was further extended toward the shoal at the lower end of East River by laying double-raft mattresses loaded with stone in the manner followed during the preceding year. Two of the cuts previously commenced were extended and deepened by dredging.

Proposals for doing the work were invited in the usual way. A contract for the jetty work was made on October 16, 1882, with Mr. J. C. Provost, of Brooklyn, N. Y., who agreed to furnish and put into the work double-raft mattresses at the price of 85 cents per square yard, brush at the price of $1 per cubic yard, and riprap stone at the price of $3.50 per cubic yard.

A contract for dredging was concluded on October 31, 1882, with Mr. J. E. Walter, of Savannah, Ga., who agreed to remove the material at the price of 27 cents per cubic yard.

Under Mr. Provost's contract the jetty was extended 2,405 feet. The bottom mattresses are 30 feet wide, except the two mattresses laid last, which are 40 feet in width. The extension occupies, mostly, comparatively shoal water, averaging 5 to 6 feet at low tide, but at the outer end for a distance of 400 feet the water deepens rapidly. The head or southern end of the jetty reaches the 18-foot low-water curve.

For the greater portion of its length, the crest of the extension reaches to the low-water line or a little above it; but on the outer, or southern length of 300 or 400 feet, which is located in deeper water, the crest gradually drops below that line. An extra amount of riprap stone was here placed upon the mattresses; but there is from 9 to 10 feet of water over the work at its extreme end at low tide.

In constructing this extension, there were employed 7,944 square yards of double-raft mattresses, 1,142 cubic yards of brush, and 1,928 cubic yards of riprap stone. The aggregate length of the jetty is now 4,199 feet, exclusive of the return face.

Under Mr. Walter's contract 28,484 cubic yards of material were re-

moved. The work consisted in deepening to a low-water depth of 15 feet, one of the two unfinished cuts previously made and extending it to the outer 15-foot curve, a length of 3,125 feet. The same cut was continued up stream a length of 400 feet, with a depth of 12 feet. The other cut could only be extended a length of 144 feet, obtaining a depth of 15 feet at mean low water.

CONDITION AND EFFECTS OF THE WORK.

The mattresses laid during the past fiscal year stand well and the older work continues in a good condition The deepest parts of the older cuts have shoaled about 2.3 feet; those of the recent cuts, about 1.6 feet.

There is now a channel of 100 feet width and 19 feet depth at mean high water, through the shoal opposite Brandy Point, excepting a length of about 1,000 feet which will carry 18 feet. For 600 feet, this channel is over 15 feet deep at mean low water.

The upper 12 foot curve, near the angle of junction of the jetty with the return face, has advanced down stream about 250 feet. Along the jetty the water is deepening until nearly opposite Brandy Point, where some shoaling is noticed. At the lower end of the channel the outer curves have somewhat advanced.

Recent observations show that the first and the last quarter of the ebb-tide pass across the upper portion of the jetty.

The improvement contemplated in the existing project has thus far been attained only in part. The jetty requires to be raised to a higher level to prevent the loss of water across its crest during ebb-tide, and dredging must be continued to more or less extent.

It is certain that additional works will be needed at the upper end of East River to increase the flow of water through the harbor of Brunswick and past the jetty, as pointed out in my annual reports of 1880 and 1882.

In my previous annual reports I have submitted some remarks on the amount of commerce and navigation that will be benefited by completing the project of improving Brunswick Harbor. I will here only add that the railroad system that terminates at that port has recently been considerably developed and extended, opening up direct rail connection with the Southwestern and Pacific States. The exportations during the year 1882 amounted to $2,700,000, exceeding in value the exports of any previous year. An early completion of this improvement seems to be very desirable.

The original estimate for work below the city will need to be increased, in consequence of the largely increased cost of dredging, and other causes. The work above the city at the upper end of Buzzard's Island, for which no estimate has heretofore been submitted, will probably cost not far from $85,000.

WORKS REQUIRED ABOVE THE CITY OF BRUNSWICK.

These works will consist essentially of a sill-dam from $2\frac{1}{2}$ to 3 feet high, composed of a log and brush mattress, ballasted with stone thrown across the main stream (Turtle River) from the upper end of Buzzard's Island to the opposite shore of Blythe Island. The sill will occupy an oblique or diagonal position across the stream, with the up-stream end resting on Buzzard's Island.

The shore ends of this sill-dam, for suitable lengths, will be raised to the level of half tide or higher, to act as training-walls, with the object

of deflecting water into Brunswick River during the ebb-tide. The sill-dam will not injure or in the least interfere with the navigation of Turtle River.

Some dredging will be necessary at the upper confluence of Brunswick and Turtle rivers.

The estimated cost of the works at the upper end of Buzzard's Island is $85,000.

No separate appropriation is requested for these upper works. The estimate of $75,000, which is submitted for the action of Congress, is intended for the works at both the upper and lower end of Buzzard's Island, to be divided between the two localities in such proportion as shall seem to be most advantageous.

This work is located in the collection district of Brunswick, Ga., at the port of entry.

Import duties and other dues collected in 1882, $20,058.90.

Since the present plan was approved and adopted, the following appropriations have been made:

By act of Congress approved March 3, 1879	$20,000
By act of Congress approved June 14, 1880	10,000
By act of Congress approved March 3, 1881	5,000
By act of Congress passed August 2, 1882	25,000
Total	60,000

The aggregate expenditures to June 30, 1883, amounted to $59,501.10.

An enlarged project, with estimates of cost, will probably be submitted during the present fiscal year.

The following papers accompany this report:

1. Chart of Brunswick Harbor, showing results of recent survey, location of works, and progress made to June 30, 1883.
2. Report of Lieut. T. N. Bailey, Corps of Engineers.
3. Commercial statistics, by the collector of customs at Brunswick.

Money statement.

July 1, 1882, amount available		$1 47
Amount appropriated by act passed August 2, 1882		25,000 00
		25,001 47
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882		24,502 57
July 1, 1883, amount available		498 90
Amount (estimated) required for completion of existing project, and for commencing additional work above the city of Brunswick	75,000 00	
Amount that can be profitably expended in fiscal year ending June 30, 1885.	75,000 00	

Abstract of proposals for dredging in Brunswick Harbor, Georgia, opened September 25, 1882.

Name and address of bidder.	Price.	Date of commencement.	Date of completion.
	Per cu. yard.		
James E. Walter, Savannah, Ga.*	$0 27	Nov. 1, 1882	Feb. 1, 1883

*Only bidder.

Contract awarded at price stated; work to be commenced on or before November 1, 1882, and completed on or before February 1, 1883.

IMPROVEMENT OF
BRUNSWICK HARBOR, GA.

showing location and progress of work of improvement to June 30th 1883 and recent soundings.

Under the direction of

Col. Q.A. GILLMORE, Corps of Engrs, Bvt. Maj. Gen. U.S.A.

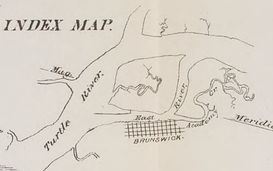
1st Lt. THOS. N. BAILEY, Corps of Engrs, in local charge.

CHAS. W. FIELD, Asst. Engineer.

Accompanying annual report, dated July 30, 1883, for fiscal year ending June 30, 1883.

Q. A. Gillmore
Col. & Bvt. Maj. Gen. U.S.A.

INDEX MAP.



BRANDY POINT.

MAG.

TURTLE RIVER.

EAST RIVER.

dry at low water.

low water line.

mud and marsh grass exposed at low water.

mud.

water

ebb current

Small houses

MERIDIAN

Mr. Collawell's Wharf

Note.

The soundings are in feet and tenths and are reduced to mean low water.
The 18 ft. curve is indicated thus: ... ...
" 15 " " " " ... ...
" 12 " " " " ... ...
Work executed on the Jetty during the last fiscal year is indicated thus:
Previous work is indicated thus:
Outlines of dredging executed during the past fiscal year are shown by a full line.
Outlines of previous dredging are shown by a broken line, thus: — — —

Surveyed May 19th to 25th, 1883, by James P. Allen, Asst. Engr.

SCALE OF FEET.

1000 900 800 700 600 500 400 300 200 100 0 1000 2000

Abstract of proposals for constructing a jetty in Brunswick Harbor, Georgia, opened September 25, 1882.

No.	Names and addresses of bidders.	Double raft.	Compact brush.	Broken stone.
		Per sq. yard.	*Per cu. yard.*	*Per cu. yard.*
1	John C. Provost, Long Island City, N. Y.....	$0 85	$1 00	$3 50
2	James E. Walter, Savannah, Ga.....	1 13	26	3 25
3	William H. Adams, New York, N. Y.....	2 20	50	3 75

Contract awarded to John C. Provost, dated October 16, 1882; to commence November 1, 1882; to complete April 30, 1883.

REPORT OF LIEUTENANT THOMAS N. BAILEY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., July 23, 1883.

COLONEL: I have the honor to submit the following report of operations during the past fiscal year for "Improving harbor at Brunswick, Ga."

The jetty has been extended 2,405 feet by sinking a layer of double-raft mattresses loaded with stone.

The mats were constructed in the manner described in your last annual report; they are 30 feet wide with the exception of the two last ones, which are each 40 feet in width and 50 feet long. The extension has been constructed in about 5 feet at mean low water, until within 400 feet of the outer end, which reaches the 18-foot curve. The crest of the extension is about 1 foot above mean low water. The aggregate length of the jetty is now 4,199 feet, exclusive of the return face.

DREDGING.

Two cuts were dredged to 15 feet at mean low water, and of an average width of 24 feet, as follows: Cut III was continued 3,125 feet from the point reached in March, 1882, to the lower 18-foot curve. This cut was also deepened from 12 feet for 400 feet inward.

Cut IV was continued outward for 144 feet from the point reached in April, 1882. The deepest parts of the old cuts have shoaled about 2.3 feet; the shoaling of the recent cuts averages 1.6 feet.

There is now through the shoal a 19-foot channel at mean low water, 100 feet wide, with the exception of about 1,000 feet which will carry 18 feet. For 600 feet the channel is over 15 feet deep at mean low water.

During the year the 12-foot channel curve, near the angle of the jetty, has advanced down stream about 250 feet; for 400 feet further along the jetty, deepening has taken place, continuing along the jetty to a point opposite Brandy Point; shoaling is noticeable outward from the latter point; no change is observed, nor is any evident, on the Brunswick side of the channel. At the lower end of the channel the outer curves have advanced in places 125 to 150 feet. The foregoing seems to indicate an outward movement of material. A recent survey of the shoal at the mouth of Academy Creek, and of the head of East River, shows no marked changes from previous maps. A map of East River in the vicinity of the jetty accompanies this report.

Table of work done.

Date.	No. mats.	Double raft.	Brush.	Stone.	Dredged.
		Square yards.	*Cub. yds.*	*Cub. yds.*	*Cub. yds.*
November, 1882	.....	.....	.....	.....	3,729.00
December, 1882	7	1,166.67	168	177.50	2,600.16
January, 1883	7	1,166.67	166	242.75	4,339.50
February, 1883	11	1,833.33	254	304.00	6,079.50
March, 1883	8	1,333.33	192	525.00	5,222.50
April, 1883	10	1,666.66	240	313.00	6,513.50
May, 1883	4	777.76	122	366.00	.....
Total	47	7,944.42	1,142	1,928.25	28,484.16

Very respectfully, your obedient servant,

THOS. N. BAILEY,
First Lieut., Corps of Engineers.

Col. Q. A. GILLMORE,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels at Brunswick, Ga., from January, 1878, to December 31, 1882.

VESSELS ARRIVED.

Years.	Coastwise.			American vessels from foreign ports.			Foreign vessels from foreign ports.			Total.		
	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.
1878	116	32,584	850	36	10,218	270	41	19,008	493	193	61,810	1,613
1879	148	44,397	1,090	33	8,235	232	40	17,589	468	221	70,221	1,790
1880	271	77,656	1,892	36	11,219	317	39	14,996	432	346	103,871	2,641
1881	279	100,451	2,239	13	4,174	98	63	30,279	751	355	134,904	3,088
1882	335	123,149	2,659	7	2,095	57	63	26,958	694	405	152,202	3,416

VESSELS CLEARED.

Years.	Coastwise.			American vessels for foreign ports.			Foreign vessels for foreign ports.			Total.		
	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.
1878	124	32,767	874	28	9,231	236	49	21,268	550	201	63,266	1,660
1879	157	42,345	1,116	21	7,172	172	47	21,730	555	225	71,247	1,843
1880	270	78,913	2,010	14	5,010	115	48	19,977	550	332	103,900	2,675
1881	252	82,155	1,732	17	7,218	156	87	42,659	1,014	356	132,032	2,902
1882	278	96,170	2,086	19	7,761	170	101	48,699	1,139	398	152,630	3,395

Years.	Value of exports.	Value of imports.	Total collections.
1878	$1,372,842	$400	$4,560 97
1879	1,394,401	3,197	5,644 33
1880	1,702,570	8,908	17,723 24
1881	2,230,000	4,377	29,305 30
1882	2,700,000	2,739	20,058 90

N. T. DRUM,
Special Deputy Collector.

SPECIAL REPORT OF CAPTAIN JAMES C. POST, CORPS OF ENGINEERS, DATED DECEMBER 29, 1882.

[Called for by Senate resolution of December 21, 1882, and printed in Senate Ex. Doc. No. 51, Forty-seventh Congress, second session.]

The harbor of Brunswick is now being improved substantially in accordance with a project submitted to the Chief of Engineers by Lieut. Col. Q. A. Gillmore, Corps of Engineers, under date of April 29, 1876.

The project provides for the construction of a jetty extending southward from the most easterly point of Buzzard's Island, opposite the city of Brunswick, and is designed to contract the water-way and to concentrate the currents in the ship-channel that leads to the city wharves; it

also provides for dredging at those points where it is necessary to aid the action of the currents in deepening the channel.

The object of these operations is to establish and maintain a ship-channel of 15 feet depth at mean low water through the shoal situated about one mile below the city, where heretofore there existed a navigable depth of only 9 feet.

Work on the jetty was begun in October, 1880. On June 30, 1882, it had reached a length of 2,104 feet, of which 1,794 feet are on the main line, parallel to the channel, while the balance forms the return face or shore connection. This work is in a satisfactory condition.

The material excavated to the same date amounted to 52,018 cubic yards. The result was a through cut, 4,400 feet long, 40 to 50 feet wide, with a depth of 15 feet at mean low water; and an unfinished cut of 1,350 feet length, 40 to 50 feet width, but only 12 feet deep. The original depth on the site of these cuts averaged 9 feet. The dredging operations were suspended in March, 1882, from want of funds, since which time some filling has taken place, reducing the depth obtained from 1 to 2 feet.

On June 30, 1882, the expenditures for the works here briefly described amounted to $35,000. They exhausted the funds thus far provided for it by Congress.

By the act of Congress passed August 2, 1882, an additional sum of $25,000 was appropriated. The larger part of it will be expended in continuing work on the jetty, and a contract was made for that purpose on October 16, 1882, with Mr. J. C. Provost, of Brooklyn, N. Y. The balance of the appropriation will be used for dredging, the contract for which was given, on October 31, 1882, to Mr. J. E. Walter, of Savannah, Ga. Both contractors commenced operations in November last. It is believed that the entire appropriation will be exhausted on or before June 30, 1883.

In regard to the question of the amount that can be profitably expended during the next fiscal year, it should be stated that while an additional appropriation of about $13,000 would seem to be all that is required, according to the original estimate of the cost of this improvement, Colonel Gillmore states, in his last annual report to the Chief of Engineers, that a revised project, with estimate of cost, will be prepared during the present fiscal year, for the reason that the original project included no estimate for works at the upper end of Buzzard's Island, at the juncture of East or Brunswick River with the Main or Turtle River. The eventual necessity for works at that point was more or less anticipated at that time, but the matter was temporarily held in abeyance.

Recent observations have shown that at the place referred to, which previously was characterized by shallow depths of water, the process of shoaling is going on. Consequently the entrance of the waters of Turtle River during the ebb tide is becoming more obstructed, and the effects of the unfinished jetty are correspondingly weakened. Complaint has also been made by the citizens of Brunswick about a bar near the mouth of Academy Creek, at the upper part of the city, which seems to require deepening. A project for works at the places indicated, with estimate of cost, should be based upon a resurvey of the upper end of East River and of the adjoining part of Turtle River. As a rough preliminary estimate it is suggested that a sum of $66,300 will probably be required for these additional works in excess of the original estimate.

It is desirable that the necessary appropriation should be made to complete the improvement of Brunswick Harbor, including some ad-

ditional works just indicated. The results aimed at in the project cannot be realized unless it is fully carried out. As shown in Colonel Gillmore's annual report of 1880, the permanent improvement of the objectionable shoal cannot be secured by the jetty alone, nor by dredging alone. The material comprising the bed of the channel is more or less refractory, and must be removed by dredging; the jetty must be completed in order to concentrate stronger currents in the excavated channel to prevent its being filled up. A suspension of the work would most probably be followed by a reduction of the depths now gained, and would continue to increase the more the period of inaction is extended.

The growing importance of Brunswick Harbor as a commercial port seems to call for an early completion of the work commenced in 1880, if not for a further enlargement of the plan of improvement. From reliable information recently received it appears that the commercial business of the place has much increased of late. It is stated that in 1875 the exports were valued at $639,000; in 1881, at $2,550,000. In 1875 there were shipped from Brunswick 39,000,000 feet of lumber and 10,000 barrels naval stores, while in 1882 the shipments amounted to 111,000,000 feet of lumber and 137,000 barrels of naval stores.

The railroads terminating at the city will shortly be connected with other existing roads, by which not only the shortest rail line from Memphis, on the Mississippi, to Brunswick and the Atlantic seaboard, will be established, through a line to be termed the Memphis, Selma and Brunswick Railroad, but also with Chattanooga and Cincinnati, by the Alabama and Great Southern and by the Cincinnati Southern railroads.

A direct communication by rail between Brunswick and the Southwestern States is being completed by means of the New Orleans and Northeastern Railroad, from Meridian, Miss., to New Orleans, and by a road from Meridian to Vicksburg and Shreveport, which, by joining the Southern and Texas Pacific Railroad, will form a direct southern transcontinental line of rails from the Pacific Ocean at San Francisco to the Atlantic Ocean at Brunswick. The various lines referred to traverse the best cotton regions of the South, as well as the rich deposits of coal and iron of Alabama and Tennessee, and their final completion can scarcely fail to increase the commercial activity of Brunswick, and to render the removal of the obstructions to the approach of vessels to her wharves more desirable.

Seventy-nine thousand three hundred dollars, the entire estimate, can be profitably expended upon this work during the fiscal year ending June 30, 1884.

Forty thousand dollars is necessary to conduct the work properly during this period.

L 11.

IMPROVEMENT OF ALTAMAHA RIVER, GEORGIA.

By the river and harbor act passed August 2, 1882, the sum of $15,000 was appropriated for continuing the improvement of Altamaha River, Georgia, which is the second appropriation made by Congress for this work. The first appropriation, to the amount of $5,000, was made by act approved March 3, 1881.

The Altamaha was examined under my direction, as provided for by section 2 of the river and harbor act approved June 14, 1880. My

report, with project of improvement, dated November 27, 1880, was printed in Appendix J 9, with the Annual Report of the Chief of Engineers for 1881, and in House Ex. Doc. No. 19, Forty-sixth Congress, third session.

The Altamaha is the most important river of Georgia, lying entirely within the boundaries of that State. It is formed by the confluence of the Oconee and Ocmulgee. It is 155 miles long, has a southeasterly course, and empties into the Atlantic Ocean through Altamaha Sound, below the town of Darien.

The chief obstruction to navigation consists in rock ledges running nearly across the stream, sand-bars and snags.

PROJECT OF IMPROVEMENT.

The project submitted with my report of the examination contemplates the establishment of a steamboat channel of 80 feet width and 3 feet depth at low-river stage, the cost of which is roughly estimated at $60,000. This estimate provides for the removal of about 10,500 cubic yards of rock, of an old wreck, and of pile obstructions, as well as of several thousand snags, all in the fresh-water reaches of the river; also for dredging about 8,000 cubic yards of material in the vicinity of Darien. The cost of improving localities where sand-bars occur is also included in the estimate, but the latter is only roughly approximate in that respect. I stated in my report that these places should be instrumentally surveyed before a proper plan for improving them can be devised.

WORK DONE PRIOR TO JULY 1, 1882.

The first appropriation, amounting to $5,000, was entirely expended in providing a snag-boat suitable for the Altamaha. This boat was completed in February, 1882. As she was designed to be also employed on the Savannah River, below Augusta, the balance of the cost of building and equipping the boat was paid out of the appropriation made for improving Savannah River and Savannah Harbor.

OPERATIONS DURING THE PAST FISCAL YEAR.

During the past fiscal year operations were confined to making an examination of the river with a view of selecting those points that should be improved by means of the appropriation made on August 2, 1882, and in inviting proposals and making a contract for removing rock at Town Bluff and Piney Bluff, and for building wing-dams and bank protections at Beard's Bluff and Marrow Bone Bar, and perhaps at one or two other places. All the points named are located within the upper 70-mile reach of the river.

The following is an extract from the specifications:

Details of work.—The wing-dams will be built upon such lines as the engineer in charge shall direct, and will be constructed of piles and slabs, or poles, as hereinafter described.

Two rows of piles will be driven 3 feet apart, the piles in each row being 5 feet center to center, and opposite corresponding piles on the other row. The top of the piles will be cut off at 6 feet above low water.

The space between the rows of piles will be filled with saw-mill slabs, edgings, or pine poles, which must be forced to the bottom and secured and held down on top by binders of 4-inch by 6-inch scantling, passing obliquely between opposite piles in the two rows, and bolted to each of the two piles by a ¾-inch wrought-iron screw-bolt, long enough to pass entirely through both pile and scantling, and to be secured with nut and washer.

The slab filling shall be carried to a height of 3 feet above low water, and the 4 by 6 scantling shall firmly rest upon this filling.

The slabs or poles shall not be put in separate piles, but must interlock so as to form a compact mass.

Shore protections.—At the junction of each dam with the shore, a structure similar to the wing-dam will be built for 50 feet, more or less, along the shore, as the engineer in charge may direct. This work will be built upon the slope of the bank, which must first be graded uniformly. Between the piles, which will be placed in two or more rows, as the engineer in charge may direct, and above them on the bank, the space will be filled in with logs and heavy slabs to a level with the top of the bank, if required, and pieces of scantling bolted across from pile to pile, as in the dams.

Similar shore protections may also be required at other points of the banks, in the section of the river indicated in these specifications, and will be constructed wherever required by the engineer in charge.

Material, &c.—The piles will be of pine, and of the length required by the engineer in charge, and will average about 27 feet in length. Their diameter at the butt shall not be over 12 inches, nor less than 10 inches, and they must be of gentle taper. They must be banded, if required, for driving, and will be driven from 12 to 15 feet below the bottom. All piles must be properly pointed. The piles will be cut off square at the required height.

The filling may be either saw-mill slabs or poles, in lengths not less than 15 feet. A portion of the filling should be of heavy pieces, to facilitate settling to the bottom. For the shore protections, some large logs will be used, together with slabs or poles. The poles must be reasonably straight.

Live and sound timber must be used for piles and either kind of filling. The filling, whether slabs, poles, or logs, will be paid for by the cord, and will be measured either in the work or otherwise, as shall be required by the engineer in charge.

The 4-inch by 6-inch scantling will be yellow pine.

The ¾-inch bolts will have square heads, nuts and washers, and will be of good merchantable quality of wrought iron.

It is proposed to expend about two-thirds of the appropriation of $15,000 for the work here indicated, and the balance for removing snags and overhanging trees, employing the United States snag-boat Toccoa for that purpose.

Of three bids received, one made by Mr. R. S. Burnett, of Savannah, Ga., was the lowest. He offered to remove rock at the price of $4.70 per cubic yard, and to furnish and put into the work piles at $2.30 apiece, slabs, &c., at $3 a cord, 4-inch by 6-inch scantling at $10 per thousand feet, board measure, and iron bolts at 5 cents per pound. With the approval of the Department, a contract was made with Mr. Burnett, on March 19, 1883.

The stage of the river was unfavorable for beginning operations, and by request of the contractor the time for completing his work was extended two months from June 30, 1883. Toward the end of June, the river then approaching its low-water stage, preparations were made for beginning work.

The United States snag-boat will be sent to the Altamaha as soon as she is through with the work allotted to her on the Salkiehatchie River, South Carolina.

OPERATIONS CONTEMPLATED DURING THE PRESENT FISCAL YEAR.

With the money on hand July 1, 1883, amounting to $14,868.21 operations will be carried on as above described. It is expected that all funds now available will be expended during the first three or four months of the present fiscal year.

The Altamaha forms a convenient and valuable water-route. Compared with its obvious importance the estimated cost of improving it, according to the existing plan, is inconsiderable. No noteworthy advantage can be obtained by limiting the expenditure for this work to the appropriations thus far made; it will be necessary to provide for the balance of the estimated cost in order to secure a continuous im-

proved steamboat route from the junction of the Oconee and Ocmulgee to the sea.

As to the benefits that may be expected to follow the completion of this improvement, I beg leave to refer to the remarks made in my report of November 27, 1880. No new data have been received since that date.

A table of commercial statistics furnished by the collector of the port at Darien accompanies this report.

This work is located in the collection district of Brunswick, Ga. Darien is the nearest port of entry.

The total collections of the custom-house at Darien during the calendar year 1882 were $11,254.19.

Money statement.

July 1, 1882, amount available	$6 10
Amount appropriated by act passed August 2, 1882	15,000 00
	15,006 10
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	137 89
July 1, 1883, amount available	14,868 21
Amount (estimated) required for completion of existing project	40,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	40,000 00

Abstract of proposals for removing rock and building wing-dams, &c., in the Altamaha River, Georgia, opened January 7, 1883.

No.	Names and addresses of bidders.	Removing rock.	Piles driven in place.	Slabs, poles, and logs.	Scantling, B. M.	Wrought-iron bolts.
		Per cu. yd.	*Each.*	*Per cord.*	*Per 1,000 ft.*	*Per pound.*
1	Frank Blaisdell, Augusta, Ga.	$6 00	$7 00	$4 00	$40 00	$0 25
2	D. V. Howell, New York, N. Y.	6 31	4 91	5 11	14 00	08½
3	Robert S. Burnett, Savannah, Ga	4 70	2 30	3 00	10 00	05

Contract awarded to Robert S. Burnett, dated March 19, 1883, to commence April 15, 1883, and complete June 30, 1883.

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels at Darien, Ga., from January 1, 1880, to December 31, 1882.

VESSELS ARRIVED.

Year.	Coastwise.			American vessels from foreign ports.			Foreign vessels from foreign ports.			Total.		
	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.
1880	66	21,539	489	1	668	13	134	68,072	1,608	201	90,279	2,110
1881	101	40,619	849	3	1,220	29	162	84,456	1,991	266	126,295	2,869
1882	117	48,208	999	1	453	9	90	51,421	1,155	208	100,082	2,163

VESSELS CLEARED.

Year.	Coastwise.			American vessels for foreign ports.			Foreign vessels for foreign ports.			Total.		
	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.
1880	55	17,076	393	7	3,589	72	168	84,172	2,016	220	104,837	2,481
1881	80	28,492	617	8	3,120	70	184	95,353	2,164	272	126,965	2,851
1882	93	34,098	709	6	1,962	46	115	63,525	1,434	214	99,585	2,189

Year.	Value of exports.	Value of imports.	Duties collected.
1880	$1,021,904	$5,600	$16,806 72
1881	1,137,496	3,356	18,980 02
1882	1,073,008	1,025	11,254 19

N. T. DRUM,
Special Deputy Collector.

SPECIAL REPORT OF CAPTAIN JAMES C. POST, CORPS OF ENGINEERS, DATED DECEMBER 29, 1882.

[Called for by Senate resolution of December 21, 1882, and printed in Senate Ex. Doc. No. 51, Forty-seventh Congress, second session.]

The Altamaha is the most important river of Georgia, lying entirely within the boundaries of that State.

It is formed by the confluence of the Oconee and Ocmulgee. It is 155 miles long, has a southeasterly course, and empties into the Atlantic Ocean through Altamaha Sound, below the town of Darien.

This river was examined in October, 1880, under the direction of Lieut. Col. Q. A. Gillmore, Corps of Engineers. The results of the examination, with a project of improvement and rough estimate of its cost, were submitted to the Chief of Engineers with Colonel Gillmore's report of November 27, 1880.

The chief obstructions to navigation consist in rock ledges running nearly across the stream, sand-bars, and snags.

The project contemplates the establishment of a steamboat channel of 80 feet width and 3 feet depth at the low-river stage, the cost of which was roughly estimated at $60,000. Colonel Gillmore states, however, that the localities where sand-bars occur, and which require improvement, should be instrumentally surveyed before a plan of improvement can be devised.

By act approved March 3, 1881, the sum of $5,000 was appropriated for beginning this improvement, which amount was entirely expended in providing a snag-boat suitable for service on this river. This snag-boat was completed in February, 1882. As she is designed to be employed also on the Savannah River, below Augusta, the balance of the cost of building and equipping the boat was paid out of the appropriations made for improving Savannah River and Savannah Harbor.

A second appropriation, amounting to $15,000, was made for this work by act of Congress passed August 2, 1882. A special examination was made in November last to select those points of the river where the appropriation might be expended to the best advantage. Preparations

will be completed in a few days for inviting proposals to have the work done by contract; if no favorable bid is received it will be recommended to do the work by hired labor and purchase of material in open market.

If the snag-boat now on duty upon the Savannah River can be spared she will be employed on the Altamaha in removing the most objectionable snags and piles, and, if possible, some rock-bars or reefs. It is believed that the appropriation will have been expended on or before the 30th of June, 1883.

After the exhaustion of the two appropriations thus far made, aggregating $20,000, there will still be required a balance of $40,000 to complete the present project, an amount which can be profitably expended during the fiscal year.

When the work of improving Altamaha River shall have been fairly begun, there can be no doubt that it should be continued without interruption until terminated. Otherwise those defective reaches that remain unimproved will continue to be obstructions to low-river navigation, and but comparatively little benefit will be derived from the money expended in improving the channel at other points of the river. The Altamaha forms an important and valuable water route, and its volume of water only requires to be properly guided at some places and the channel free from obstructions at others, which may be done at a comparatively small cost, to offer greatly increased facilities for the transportation of timber, naval stores, and rice, the staple produce of the country through which it flows or which is naturally tributary to it.

Forty thousand dollars can be profitably expended during the fiscal year ending June 30, 1884.

As to the amount that is considered necessary to be appropriated at this session of Congress to conduct this work as it should be, it may be said that, in order to do the work as economically as possible, and to secure the advantages to be produced by it at the earliest date, the sum of $40,000, equal to the full balance of the estimate not yet appropriated, is necessary.

L 12.

IMPROVEMENT OF ENTRANCE TO CUMBERLAND SOUND, GEORGIA AND FLORIDA.

During the fiscal year ending June 30, 1883, the work of improving the entrance to Cumberland Sound, Georgia and Florida, was continued in accordance with the project submitted with my report of June 30, 1879, printed as Appendix I_8, Annual Report of the Chief of Engineers for 1879.

PLAN OF IMPROVEMENT.

The plan of improvement comprises the construction of two low jetties, composed of riprap stone resting on a foundation mattress of logs, or logs and brush, starting respectively from the shores on opposite sides of the entrance and extending seaward across the bar, upon lines so directed that the outer ends will be parallel to each other, and from 2,500 to 3,000 feet apart, or such distance as may hereafter be deemed necessary.

The available low-water depth upon the bar has heretofore varied from 11 to 13 feet, with a mean rise and fall of tides of about 6 feet. Two low jetties, reaching entirely across the bar, would be expected to

maintain a low-water channel not less than 20 to 21 feet deep. Greater depth may be secured by carrying the jetties to higher levels.

The cost of the work is estimated at $2,071,023.

Since the foregoing project was adopted three appropriations have been made by Congress for this work, aggregating $180,000.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1882.

North jetty.—The work of laying the apron or foundation course of the north jetty was begun in June, 1881. The shore end of the jetty is located on the east shore of Cumberland Island, about 2,000 feet from its southern end. From this initial point the jetty extends 2,200 feet on a range bearing south 63½ degrees east. Upon this range Cumberland Channel is crossed. The work is then laid on a second range bearing south 80 degrees east, which direction will bring it to the North Breakers, north of Pelican Shoal. The nearest distance of the axis of the jetty, second range from the opposite shore of Amelia Island near Fort Clinch, is about 1 mile.

On June 30, 1882, the total length of the apron foundation was 7,372 feet. It is composed of mattresses of logs and brush from 25 to 52 feet in width, and from 19 to 22 inches in thickness. A second course of mattresses of similar thickness, from 20 to 25 feet in width, and aggregating 1,366 feet in length, was placed upon the apron at the deeper portions of Cumberland Channel.

All this mattress work was held in place by riprap stone distributed over it, amounting to 11,137 cubic yards.

South jetty.—This work was commenced in June, 1882. Its starting point is located on the eastern shore of Amelia Island, about 5,700 feet from Fort Clinch.

On June 30, 1882, the apron foundation extended 1,316 feet from shore, on a range bearing due east. The mattresses were from 40 to 50 feet wide, and about 21 inches thick.

Riprap stone, to an aggregate amount of 2,443 cubic yards, was deposited upon the mattresses.

The total expenditures, from the beginning of work to June 30, 1882, were $110,256.89.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1883.

During the past fiscal year the work was continued by means of the balance on hand on July 1, 1882, amounting to $19,743.11, and of an appropriation of $50,000 made by act of Congress passed August 2, 1882.

Work was done on both jetties, the larger amount of it on the south jetty.

The contract made with Mr. A. M. Newton during the preceding fiscal year was terminated in September, 1882.

When the last appropriation of $50,000 became available proposals were invited for expending that sum in continuing the work on the jetties. Two designs for mattresses were described in the specifications, either one of which might be used at the option of the contractor. These designs are identical with those now employed at the mouth of the Saint John's River, of which a detailed description is given in my annual report of that improvement for the fiscal year just passed.

Messrs. A. S. Lara and R. G. Ross were the lowest bidders. Their prices—85 cents yer square yard for mattresses, and $3.70 per cubic yard for riprap stone—were considered reasonable, and a contract was made with them on September 25, 1882.

Operations under this contract were begun in October, 1882, and brought to a close in March, 1883.

North jetty.—The second course of mattresses previously laid was extended a length of 73 feet. The foundation mats for two spurs were placed adjoining the south edge of the jetty apron, at distances of 1,625 feet and 1,800 feet, respectively, from the high-water line on shore. They were covered with riprap stone to an average thickness of 12 inches. An extra quantity of stone was distributed over portions of the work previously laid, especially where depressions existed, which acted as sluiceways for the currents in Cumberland Channel. The amount of stone used on this jetty during the year aggregated 4,475 cubic yards.

South jetty.—During the past fiscal year the foundation course was extended 2,851 feet. The first 303 feet of this length are directed due east, like the work previously laid; the balance of 2,548 feet follows a range north 68 degrees 32 minutes east. The mattresses vary in width from 50 to 87 feet. The low-water depths in which they were sunk increase in a seaward direction from 3½ feet at the inner end to about 23 feet at the seaward end. The work has now reached the deep portion of the deep-water pocket east of Amelia Island.

The riprap stone placed on the south jetty during the whole year amounted to 7,350.5 cubic yards.

Congress having made no appropriation for this improvement at its last session, work will remain suspended until additional funds are supplied.

CONDITION OF THE WORK AND CHANGES IN THE OUTER HARBOR.

The works are, on the whole, in a satisfactory condition.

At several points of the outer branch of the north jetty, which is located in shallow water, northeasterly gales have swept the stone off the mattresses, throwing it in irregular piles to the southwest of the jetty. In consequence the bared logs suffer from the attacks of the teredo, though apparently not yet to a serious extent. Along the greater portion of the north jetty, except in Cumberland Channel, where it is crossed by rather str ng currents, sand and shells are collecting between the logs. On the south side of mattresses a growth of barnacles and oysters is observed.

On nearly the whole length of the same work, except a few hundred feet of the extreme easterly portion, the depth of water has increased 3 or 4 feet on the south side since last year's report, but no material changes of depth have been observed on the north side. The seaward end has settled somewhat.

The foundation course of the south jetty has settled in shallow water, while sand has accumulated over it to a remarkable extent in deep water.

Both Pelican and Kingsley banks have increased in area.

The sailing line across the bar remains practically in the location where it was last year. No changes have as yet been produced in the depths of the bar channel that can be ascribed to the influence of the inconsiderable works thus far executed.

Two new spurs were built last year, in addition to five spurs constructed in 1881, for protecting the site of Fort Clinch, and thereby incidentally the western part of the north shore of Amelia Island. This work was done by means of allotments from the appropriation for repair and preservation of fortifications. The eastern part of said shore is growing seaward.

In my annual report of this improvement, for the fiscal year ending June 30, 1881, printed as Appendix J 11, of the Annual Report of the Chief

of Engineers for 1881, I made some remarks concerning the advantages which the harbor of Fernandina possesses on account of its large capacity and its deep and well sheltered anchorage. With an improved bar channel the harbor will at once become more valuable and important, not only for maritime commerce, but also for naval purposes, since iron-clads and other large iron-hulled vessels can then enter Cumberland Sound and proceed up Saint Mary's River, where at a distance of about 30 miles from the main harbor and anchorage they will find deep and entirely fresh water.

Even now Fernandina is doing a considerable and growing business in the way of shipping timber, lumber, naval stores, and cotton-seed, her connections by land and water furnishing access to the richest portions of Florida and Southern Georgia. These lines of communication were referred to in my annual report of 1881. A new railroad scheme, now in progress, promises to give an uncommon impulse to the development of the commerce of Fernandina. A new trunk railroad is about to be established for connecting the Atlantic with the Pacific Ocean, with Fernandina Harbor as the eastern terminus, and the Mexican harbor of Topolovampo, on the Gulf of California, as the western terminus. Of all the transcontinental rail routes now existing, or in progress of construction, this line when completed will unquestionably be the shortest rail connection between two United States ports located respectively on the Atlantic and the Pacific coast. The route will furnish access to and aid the development of the extensive deposits of gold, silver, copper, and other valuable minerals abounding in Northern Mexico, while its eastern branch, with its lateral connections, will provide convenient transportation for the products of the rich coal and iron regions of Alabama and Georgia, of the immense yellow-pine forests of these and other Southern and Southwestern States, and of the cotton-fields of the South generally.

The importance of such a short transcontinental railroad to the commercial and maritime interests of Fernandina is obvious; but its value will not be fully developed until the work of improving the entrance to the harbor shall be completed. Attention is also invited to a letter of the president of the Florida Central and Western Railroad, appended to this report, which supplies interesting information in regard to recent improvements made in the railroad system terminating at Fernandina, and to the prospective connection of that port with Liverpool by a line of steamers.

This work is located in two collection districts, the north jetty being in the collection district of Saint Mary's, Ga., and the south jetty in that of Fernandina, Fla. Fernandina is the nearest port of entry. Import duties collected during the calendar year 1882, $36,590.

The following appropriations have been made for this work:

By act of Congress approved June 14, 1880	$30,000
By act of Congress approved March 3, 1881	100,000
By act of Congress passed August 2, 1882	50,000
Total	180,000

The estimated cost of the improvement is $2,071,023. The total expenditures, from the beginning of the work to June 30, 1883, were $178,714.15, including outstanding liabilities.

The following papers accompany this report:

Sheet 1.—Chart of entrance showing progress of work and recent soundings.
Sheet 2.—Sketch showing spur jetties for the protection of the site of Fort Clinch.
Report of Lieut. W. T. Rossell, Corps of Engineers.
Letter of the president of the Florida Central and Western Railroad.
Table of commercial statistics furnished by the collector of the port of Fernandina.

IMPROVEMENT OF THE ENTRANCE TO CUMBERLAND SOUND, GA. & FLA.

Showing the sites of the North and South Jetties,
the progress made in their construction to June 30, 1883
and the present depths on the bar.

Under the direction of
Colonel Q. A. Gillmore, Corps of Engineers, Bvt. Maj. Gen. U.S.A.
First Lieut. W.T. Rossell, Corps of Engineers, in local charge.
Accompanying annual report of July 30th 1883
for the fiscal year ending June 30, 1883.

Q. A. Gillmore
Col. Engrs. Bvt. Maj. Gen. U.S.A.

CUMBERLAND I.

BREAKERS

Pelican Shoals

North Shoal

NORTH BREAKERS

City of Austin Shoal

AMELIA Ip

Tiger Creek

TIGER Ip

AMELIA RIVER

Ft. Clinch

Ordnance Serg't.

QUARANTINE BUOY

DAY BEACON

RANGE LIGHTS

Kingsley's Bank

WAR BUOY No 3

2046'

2121'

5172'

The soundings are expressed in feet and tenths and referred to the U.S. Coast Survey datum of Mean Low Water.
The Mean Low Water Line is marked thus :
The 6 feet curve is marked thus :
" 12 " " " " "
" 18 " " " " "
" 24 " " " " "

Scale of Chart.

500 0 500 1000 1500 2000 2500 3000 3500 5000 feet.

Longitudinal Section of South Jetty

Mean High Water
Mean Low Water
2046'
2121'

Longitudinal Section of North Jetty

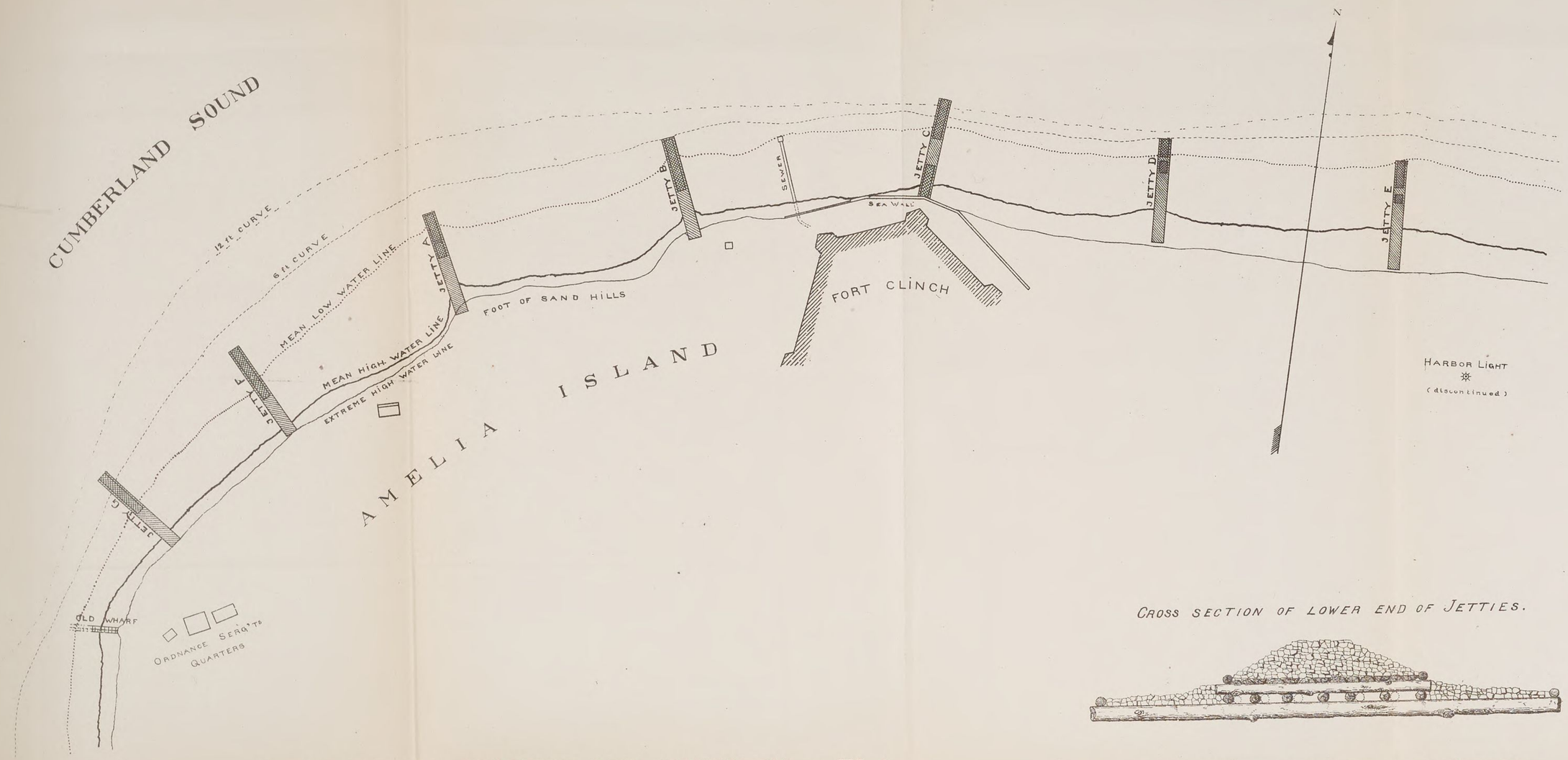
2200'
5172'
Mean High Water
Mean Low Water

Scales for Sections

VERTICAL 10 5 0 10 20 30 40 feet

HORIZONTAL 500 0 500 1000 1500 2000 feet.

JETTY
LIN



CROSS SECTION OF LOWER END OF JETTIES.

CROSS SECTION OF UPPER END OF JETTIES.



ENTRANCE TO CUMBERLAND SOUND, GA & FLA.

Sketch showing location of Spur Jetties constructed in 1881 and 1883
for the protection of the site of Fort Clinch.
Accompanying annual report of July 30, 1883,
for the fiscal year ending June 30, 1883.

Scale for Plan.

160 120 80 40 0 160 320 480 640 800 ft.

SCALE FOR SECTIONS.

4 3 2 1 0 4 8 12 16 20 FEET.

Q. A. Gillmore
Col. Corps of Engrs. Bvt. Maj. Gen'l U.S.A.

Money statement.

July 1, 1882, amount available	$19,743 11
Amount appropriated by act passed August 2, 1882	50,000 00
	69,743 11
July 1, 1883, amount expended during fiscal year exclusive of outstanding liabilities July 1, 1882	68,457 26
July 1, 1883, amount available	1,285 85
Amount (estimated) required for completion of existing project	1,891,023 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	600,000 00

Abstract of proposals for constructing jetties at entrance to Cumberland Sound, Georgia and Florida, opened August 28, 1882.

No.	Names and addresses of bidders.	Mattresses.	Riprap stone.
		Per sq. yd.	*Per cu. yd.*
1	Sheldon S. Pratt, Fayetteville, N. Y	$1 10	$3 88
2	E. L. Richardson, New York, N. Y	96	3 87
3	Frank P. Murphy, Washington, D. C	97	3 74
4	Lara & Ross, Staunton, Va	85	3 70
5	Geo. W. Rogers, New York, N. Y	95	3 75

Contract awarded to Messrs. Lara & Ross, dated September 25, 1882; to commence September 25, 1882, and complete February 28, 1883.

REPORT OF LIEUTENANT WILLIAM T. ROSSELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Jacksonville, Fla., July 1, 1883.

COLONEL: I have the honor to submit the following report upon the work of improvement of the entrance to Cumberland Sound, Georgia and Florida, for the year ending June 30, 1883.

The project for the improvement of this place included the construction of converging jetties. These jetties were to be built of mattresses of wood, held in position by stone.

Previous to this year (1882–'83) a portion of both jetties, north and south, had been constructed as follows:

	Feet.
North jetty:	
Foundation course	7,372
Second course	1,366
Total length of both courses	8,738
South jetty:	
Foundation course	1,316

At the close of the fiscal year June 30, 1882, there was a small amount of work to be done under the contract of A. M. Newton. This consisted in placing stone on the north jetty where deficiences existed, and in placing one second-course mattress 73 feet long by 25 feet wide. This was finished in September, 1882.

Under the appropriation for the fiscal year 1882–'83, a contract was made with Lara & Ross for jetty construction.

Under this contract work was done on both jetties. On the north jetty an additional amount of stone was placed—325 yards—and two small spurs were built on the south side. At this place a depression was found in the jetty, and it was feared that a break might occur Since the construction of the spurs it has slightly sanded up. These spurs were each 54 feet long and 42 and 43 feet wide, respectively.

On the south jetty the foundation course has been extended for a distance of 2,851 feet, of which 303 feet were laid on the extension of the same line as the portion laid the year before, and the remainder, by your direction, on a line north 68 degrees 32 minutes, east. The mattresses varied in width from 50 feet to 87 feet, the depth of water varying from 2 feet to 23.2 feet at mean low water.

LENGTH OF JETTIES JULY 1, 1883.

	Feet.
North jetty:	
Foundation course	7,372
Second course, laid to June 30, 1882	1,366
Second course, laid since	73
Total both courses to July 1, 1883	8,811
South jetty:	
Foundation course, laid to June 30, 1882	1,316
Foundation course, laid since	2,851
Total foundation course to July 1, 1883	4,167

A survey of this harbor was made under your direction in April, 18-3. This shows the work to be in good condition. Along the sides and near to each jetty the water has deepened slightly, and some settlement has taken place. The north jetty being in many places above mean low water, the northeast storms have washed off considerable of the stone, especially where mattresses lap on one another. At these places piles of stones are found to the southwest of places now bare of stone. On the south jetty considerable settlement is shown at the shoals, but in the deeper water at the sea-end of the jetty an apparent sanding-up that is surprising. This latter may be an error in sounding on the part of the inspector when the mattresses were sunk, but this could only account for a small difference.

Comparing this chart with the one made by Mr. Danbeney in 1879, it will be seen that the 18-foot curve has moved abont 1,100 feet seaward; that Pelican Shoal has increased, as has also Kingsley's Bank. The banks at Fort Clinch and to the westward have washed away from 50 to 100 feet, while to the eastward it has built up.

In order to avoid any further washing of the banks at Fort Clinch, spur-jetties have been built.

Before the fiscal year 1882–'83 five jetties were constructed marked A, B, C, D, and E. These jetties were made of mattresses of logs held together by binders and covered in the middle with poles to a thickness of 6 inches.

Where but a single course was used the mats were made 35 feet wide, and where two courses were used a double mat was used, bottom one 35 feet wide, and second course 16 feet wide.

These jetties were made the following lengths:

	Feet.
Jetties A and E	220
Jetties B and D	243
Jetty C	300

These jetties had the effect of building out the low-water line somewhat, but the wash still continued to the westward somewhat.

By your direction jetties A, B, D, and E were extended to 300 feet in length, and jetty C raised near the fort sea-wall, to build out, if possible, to the high-water line. Two new jetties, F and G, were also constructed, the first 600 feet west of jetty A, and the second 450 feet farther west. The amount of work done during the fiscal year 1882–'83 on these jetties is as follows:

Jetties.	Length of single mat.	Length of double mat.	Total length.
	Feet.	*Feet.*	*Feet.*
A	4.0	83.5	87.5
B	.....	56.0	56.0
C	100.0	.....	100.0
D	11.8	56.0	67.8
E	22.0	81.0	103.0
F	128.5	170.0	298.5
G	147.0	153.0	300.0

This gives for the present length of these jetties—

	Feet.
Jetty A	307.5
Jetty B	300.0
Jetty C	300.0
Jetty D	311.8
Jetty E	323.0
Jetty F	298.5
Jetty G	300.0

The result so far has been merely to stop the wash; some filling has taken place, but not very much.

Of these works the north jetty is in the collection district of Saint Mary's, Ga., and the south jetty and spur-jetties in the collection district of Fernandina, Fla.; Saint Mary's, Ga., and Fernandina, Fla., are their respective ports of entry, the latter being nearest the work.

The entrance to this harbor is defended by the guns of Fort Clinch.

I am, very respectfully, your obedient servant,

WM. T. ROSSELL,
First Lieut. of Engineers.

Col. Q. A. GILLMORE,
Corps of Engineers, U. S. A.

LETTER OF THE PRESIDENT OF THE FLORIDA CENTRAL AND WESTERN RAILROAD.

FLORIDA CENTRAL AND WESTERN RAILROAD COMPANY,
PRESIDENT'S OFFICE, MILLS BUILDING,
New York, July 17, 1883.

DEAR SIR: I understand that the question of an appropriation for the harbor at Fernandina is under consideration by yourself, and I would like to call your attention to the fact that the Florida Central and Western Railroad, at present running from Jacksonville to Chattahoochee, a distance of 214 miles, and the Florida Transit and Peninsula, from Fernandina to Cedar Keys, with a branch from Waldo to Wildwood, and a total mileage of 231 miles, are to be consolidated, making the terminus of the consolidated system at Fernandina. This will embrace, as you see, 445 miles of completed road; and, in addition, we expect to extend the Florida Transit and Peninsula south 160 miles, making a total of 605 miles tributary to Fernandina.

In addition, I would say, that there is at present a semi-weekly line of steamers between Fernandina and New York, which is to be made tri-weekly this fall, and we have reliable assurances that as soon as this consolidation is completed and the entire system of roads extended and operated to Fernandina, a line of steamers will be put on between Fernandina and Liverpool, sufficient to do all the business that may offer, and as this will afford the shortest rail route from the Lower Mississippi and the country intervening on a line to Fernandina to the seaboard, we anticipate building up a large business, the success of which will greatly depend upon the harbor facilities at Fernandina, and I hope that you may see your way clear to recommend a liberal appropriation for that harbor.

Yours, truly,

B. S HENNING,
President.

General Q. A. GILLMORE.

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels at Fernandina, Fla., from January 1, 1877, *to December* 31, 1882.

VESSELS ARRIVED.

Years.	Coastwise.			American vessels from foreign ports.			Foreign vessels from foreign ports.			Total.		
	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.
1877	150	100, 581	3. 343	32	8, 088	217	40	12, 541	404	222	122, 200	3, 782
1878	185	120, 865	3, 900	16	3, 985	101	42	8, 294	215	223	133, 144	4, 225
1879	199	133, 309	4, 138	28	9, 634	252	10	5, 645	126	237	148, 588	4. 516
1880	260	156, 740	4, 470	34	22, 396	598	22	9, 463	240	316	188, 599	5, 308
1881	227	171, 584	4, 186	17	11, 865	314	24	11, 592	271	268	195, 041	4, 771
1882	248	146, 422	3, 274	16	9, 056	242	15	6 639	151	279	162, 117	3, 667

Arrivals and clearances of vessels at Fernandina, Fla., &c.—Continued.

VESSELS CLEARED.

Years.	Coastwise.			American vessels for foreign ports.			Foreign vessels for foreign ports.			Total.		
	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage,	Crew.	Number of vessels.	Tonnage.	Crew.
1877.....	165	106, 638	3, 590	24	6, 340	166	42	13, 641	412	231	126, 619	4, 168
1878.....	195	124, 883	4, 086	19	4, 911	123	25	9, 080	236	239	138, 874	4, 445
1879.....	205	129, 650	4, 079	31	11, 066	258	12	8, 026	164	248	148, 742	4, 501
1880.....	246	155, 649	4, 505	31	14, 161	327	24	10, 202	240	301	180, 012	5, 072
1881.....	204	137, 638	3, 730	41	22, 018	506	31	15, 335	351	276	174, 992	4, 587
1882.....	217	138, 676	3, 166	39	15, 507	370	30	14, 963	321	286	169, 146	3, 857

Years.	Value of exports.	Value of imports.	Duties collected.
1877	$315, 446	$19, 639	$2, 376
1878	258, 184	11, 862	2, 090
1879	283, 476	11, 047	3, 424
1880	259, 514	15, 679	7, 808
1881	377, 887	14, 537	8, 183
1882	364, 513	43, 645	36, 590

C. V. HILLYER,
Deputy Collector.

SPECIAL REPORT OF CAPTAIN JAMES C. POST, CORPS OF ENGINEERS, DATED JANUARY 11, 1883.

[Called for by Senate resolution of January 2, 1883, and printed in Senate Ex. Doc. No. 49, Forty-seventh Congress, second session.]

The improvement of the entrance to Cumberland Sound, Georgia and Florida, is carried on in conformity to a project submitted to the Chief of Engineers by Lieut. Col. Q. A. Gillmore, Corps of Engineers, with his report of June 30, 1879, printed as Appendix I 8, Annual Report of the Chief of Engineers for '879.

The plan of improvement comprises the construction of two long jetties, composed of riprap stone resting on a foundation mattress of logs, or logs and brush combined, starting respectively from the shores on opposite sides of the entrance, and extending seaward across the bar.

These two jetties are expected to maintain a low-water channel not less than from 20 to 21 feet deep. The draught of water that can be carried over the Fernandina Bar in its unimproved condition varies from 11 to 12½ feet at mean low tide, with exceptional depths 1 foot greater, and a mean rise and fall of tides of about 6 feet.

The cost of the project is estimated at $2,071,023.

An aggregate sum of $180,000 has been appropriated by Congres for this work since the existing project was adopted.

Operations were commenced in June, 1881. The foundation course of the north jetty, which has its shore end on Cumberland Island, has at present reached a point 7,372 feet from shore; and 1,366 feet of this length is overlaid with a second course of log mattresses and riprap stone.

The foundation course of the south jetty, which starts from Amelia Island, has reached a length of about 1,970 feet.

The condition of the work at the present time is substantially the same as it was described to be in the annual report of Colonel Gillmore for the fiscal year ending June 30, 1882. No notable changes in the general condition of the two jetties had then occurred. It was stated that in Cumberland Channel, which is crossed by the north jetty, the strength of the currents seems to have somewhat increased, and that both above and below the line of crossing there is now deeper water to be found than formerly. The work had not settled, however, and was well covered with sand in said channel, but it was remarked that it would be necessary to raise the work higher.

In the very shallow water where the present easterly end of the north jetty is located, strong currents cross it at all the numerous low places, augmenting in force as the tide rises. These currents produce scour alongside of the jetty, but more especially beyond its present eastern end. For this reason Colonel Gillmore states that—

> If operations have to be suspended for a considerable length of time, or cannot be carried on upon a sufficiently large scale, it may be expected that this process of scouring and deepening will be inconveniently developed to such a degree, probably, as to add very considerably to the cost of the work.

The report also says that these shoal-water currents prevent the accumulation of drift sand upon the mattresses, and therefore expose the logs to the attacks of the teredo, for which reason riprap stone should be liberally distributed on the foundation apron to protect it, and to bring the crest of the work to a greater height.

Subsequent examinations have shown that the logs where exposed, or not sufficiently covered with stone, are seriously suffering from the cause here indicated.

Operations which were suspended in September, 1882, from lack of funds, were resumed during the following October, an appropriation of $50,000 having been made for this improvement by the act passed August 2, 1882. Under the contract made for this purpose the whole amount thus made available is expected to be exhausted on or about February 28, 1883, and work will probably be suspended soon after that date.

The question whether there is any necessity for an immediate appropriation for the protection of the works already constructed from deterioration by the action of waves may be answered in the affirmative, especially if it is not contemplated to provide for an appropriation for the next fiscal year. A long suspension of operations will be accompanied by increasing deterioration of the logs forming the foundation of the work, which is not yet covered and protected by a sufficient thickness of riprap stone, while the incessant action of waves and currents prevents the accumulation of sand on top and alongside of the log apron. There is, therefore, danger that a large portion of the stone already deposited will gradually be deprived of its support and be sunk and lost in the drifting sands upon which the foundation rests.

Moreover, the funds thus far provided were practically sufficient only to make a beginning of the work. Even if it should remain intact during a forced interval of inaction from want of appropriations no benefit to commerce and navigation will be derived from the outlay thus far made, since the effects of the work in its present rudimentary condition are inappreciable.

It is thought that an immediate appropriation of $100,000 could be advantageously expended during the remaining part of the present fiscal year for the purpose named in the resolution of the Senate.

In regard to further appropriations for this improvement, Colonel Gillmore says in his last annual report to the Chief of Engineers:

It may be said, however, that the work of improving the entrance to Cumberland Sound having been now fairly begun, it seems desirable that it should be pushed forward with vigor. With large appropriation, which implies favorable contracts with responsible and efficient parties, the ground to be eventually occupied by the jetties can be covered more rapidly, avoiding thereby the greater expense that will naturally be connected with slow progress or suspension by allowing the currents time to deepen the bar ahead of the jetties; while the ever-changing condition of the bar and of the channels leading through the same, as long as the currents are not suitably controlled by the jetties, will complicate the problem and still more increase the cost of the work.

An appropriation of the amount before mentioned ($100,000) without an additional sum being made available for the fiscal year ending June 30, 1884, would necessarily involve a complete suspension of the work during the greater portion if not for that entire year. This would undoubtedly be followed by deterioration, the necessary consequence of incomplete work being exposed to the natural action of the elements. To avoid this and to make sure that the work would be vigorously advanced towards completion during the next fiscal year, an additional amount of $500,000 should be appropriated.

Very respectfully, your obedient servant,

JAS. C. POST,
Captain of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

L 13.

IMPROVEMENT OF SAINT JOHN'S RIVER, FLORIDA.

During the fiscal year ending June 30, 1883, the work of improving the channel over the bar at the mouth of the Saint John's River, Florida, was continued in conformity to the project submitted in my communication to the Chief of Engineers dated June 30, 1879, and printed as part of Appendix I 7 of the Annual Report of the Chief of Engineers for 1879.

PROJECT OF IMPROVEMENT.

The plan of improvement essentially consists in the construction of two low jetties built of riprap stone, supported by a foundation mattress or platform of logs, with a mattress hearting wherever found practicable to reduce the cost of the work.

Two plans were discussed, differing from each other in magnitude and probable effects.

One plan contemplated the construction of two long jetties, starting from the opposite shores of the entrance and extending seaward across the bar. It was intended thereby to establish a mid-channel depth of 15 feet at mean low water. The usual available low-water depth over the bar in its unimproved condition was 6 feet, more or less, with a mean rise and fall of tides of about 5 feet.

The cost of this project was estimated at $1,306,409.

By the other or more restricted plan, only one long jetty, that upon the north shoal, would be constructed, and a short spur on the south

side. It was assumed that these works would suffice in securing a practicable high-water depth equivalent to, and perhaps exceeding, the greatest draught that can at present be carried from the bar to Jacksonville.

The cost of this plan was estimated at $800,000.

The cost of improving some deficient reaches of Saint John's River between Jacksonville and the bar, roughly estimated at $120,000, was not included in the estimate of the cost of the larger project. These works will be needed when a low-water depth of 15 feet or more has been established on the bar. They are considered to be properly the subject of a special project. If they are not to be built by means of a separate appropriation, the estimate of the cost of the larger project will have to be correspondingly increased.

Since the adoption of the general plan of improvement of June 30, 1879, operations have been carried on in conformity to the larger project. Since that date three appropriations were made by Congress for this work, aggregating $375,000.

Previously a total sum of $57,476.28 was expended in dredging for the temporary improvement of the bar-channel since the close of the late civil war.

For making the preliminary surveys and preparing the project the sum of $2,523.74 was expended.

SUMMARY OF OPERATIONS PRIOR TO JUNE 30, 1882.

North jetty.—The work of laying the apron or foundation course of the north jetty was commenced in January. 1882. On June 30 of that year the apron had reached a length of 1,115 feet, the land end being located at the low-water line on Fort George Island. The mattresses, log and brush, or logs and poles together, aggregated from 19 to 22½ inches in thickness, and they varied from 42 to 60 feet in width. They were held in place by 2,162 cubic yards of riprap stone distributed over them. The axis of the jetty is a straight line bearing south 73 degrees east. Near the seaward end of the work, east of it, is a large shoal known as Ward's Bank.

South jetty.—This work was commenced in December, 1880. On June 30, 1882, the apron or foundation course had an aggregate length of 4,813 feet, of which 874 feet formed the shore branch of the jetty, bearing north 46 degrees 45 minutes east. The main line begins at a point 74 feet back from the outer end of the shore branch. For a length of 3,538 feet it follows a straight course bearing north 74 degrees 54 minutes east; the next length of 328 feet is deflected 1 degree to the east, and the last 73 feet is deflected 2 degrees more to the eastward.

The mattresses of the bottom course were of the same kind as used on the north jetty, and varied from 20 to 87 feet in width; their thickness from 19 to 21 inches, and stone was distributed over them to an average thickness of 15 inches.

A second course, from 42 to 77 feet in width, covered 3,002 linear feet of the main line of jetty. A third, fourth, and fifth course of mattresses was also laid on portions of the main line, their aggregate lengths being, respectively, 1,776 feet, 1,380 feet, and 331 feet. The mattresses of these several courses were about 8 feet less in width than those immediately below them.

Eight spur-jetties were constructed, four on each side of the jetty, opposite to each other. They are located at distances of from 500 to 1,800 feet from the angle of junction of the main line with the shore

branch, and were formed of two courses of mattresses. The foundation courses of the spurs project from 81 to 98 feet from the bottom course of the main line; those on the north side measure 75 feet in width; on the south side 100 feet. These spurs were designed to prevent the strong scour that had begun to be developed on both sides of the jetty from endangering the structure.

On June 30, 1882, about 1,000 feet in length of the main line, next to the angle of junction, reached up to the level of low water. The next adjoining length of 500 linear feet was about 1 foot lower, and the balance from 2 to 13½ feet below the level of low water. The latter depth, located about 700 yards from the angle of junction, was temporarily reserved, on a length of 300 feet, to permit vessels to cross the jetty, the work not having yet advanced far enough to force the main channel across the bar into the position designed for it north of the south jetty.

From the beginning of work to June 30, 1882, riprap stone to the amount of 24,533 cubic yards has been used in the construction of the south jetty.

The total expenditures to the same date for both jetties were $218,228.82, including outstanding liabilities.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1883.

During the past fiscal year operations were carried on by means of the appropriation of $150,000 made by act passed August 2, 1882, and of the small balance on hand on July 1, 1882, amounting to $6,771.18.

All the work was done on the south jetty, and to a great extent with a view to insuring its safety, which at several points had been seriously compromised since the end of the preceding fiscal year. The deterioration of the work at these points was due to the effects of scouring currents, which had become especially violent on the south side of the jetty.

The original foundation course of the south jetty was therefore enlarged by a revetment or apron of mattresses, from 40 to 60 feet in width, placed along its south edge, beginning at low-water mark and extending about 2,113 feet eastward. This apron was still further widened for a length of 1,509 feet, beginning about 500 feet east from the angle of junction with the shore branch, by an additional revetment of mattresses 40 feet in width.

At several places the jetty was raised by putting on additional courses of mattresses and riprap stone. The aggregate length of these upper courses, laid during the past fiscal year, amounted to 2,119 feet.

The United States dredge steamer Henry Burden was sent from Savannah, Ga., to the mouth of Saint John's River, and remained there a few months. It was hoped that she would be able to render some aid in promoting the formation of a new ship-channel, but she could accomplish but little, owing to the shallowness of the water on the bar.

A considerable amount of hydrographic work was done during the year, to observe the changes going on at the bar and in the vicinity of the jetties.

Operations under the contract made with Mr. J. H. Durkee, referred to in my last annual report, were brought to a close toward the end of July, 1882, the funds having become nearly exhausted. During that month 1,001.56 cubic yards of riprap stone were deposited by him upon the south jetty.

When the appropriations made by the act of August 2, 1882, became available, proposals were invited for continuing the work of improvement. Two designs for mattresses were described in the specifications,

either of which might be used, at the option of the contractor. These designs were as follows:

First design.—This mattress is a raft of round logs, not less than 12 inches in average diameter, and not less than 9 inches in diameter at the small end, placed in close contact, side by side, at right angles to the line of the jetty, and firmly held there by transverse pole-binders spiked or bolted to them. There will be placed upon the raft of logs a layer of live-wood brush, sufficient to give 5 inches in thickness in the finished work, secured in place by poles lashed to the binders of the raft. The binders will be smaller logs or poles, not less than 4 inches in depth at the small end, and placed not more than 8 feet apart, and those on the outside will be close to the end of the logs.

Second design.—This mattress will consist of a bottom grillage of poles, of an average diameter of at least 6 inches, and not less than 5 inches in diameter at the small end, placed from 4 to 6 feet apart between centers, both longitudinally and transversely, and the lower poles will be parallel to the line of the jetty. The spaces between the upper poles of this bottom grillage will be filled in with similar poles. Upon this raft will be placed two layers of stout hard-wood brush, crossing each other at right angles, each course to be 5 inches thick in the finished jetty, to be followed by a top grillage constructed like the one placed at the bottom. The upper layer of brush will be placed at right angles to the line of jetty. The poles of each grillage will be securely lashed together by suitable wire or rope lashings, and the upper and lower grillages will also be securely lashed together, in such a manner as the engineer in charge shall approve, so as to form a strong and compact mattress, not less than 16 inches thick in the finished work, the thickness being estimated between the bottom poles of the upper and the top poles of the lower grillage.

Of six proposals received and opened August 28, 1882, one made by Mr. A. A. Howlett, of Syracuse, N. Y., was the lowest. He offered to furnish and put in the work mattresses at the price of 65 cents per square yard and riprap stone at the price of $3.25 per cubic yard. With the approval of the Chief of Engineers, a contract was made with Mr. Howlett on September 13, 1882.

Operations under this contract did not begin before the middle of November, 1882, owing to an epidemic prevailing during the fall of that year. Subsequently, serious delay was caused by exceptionally bad weather throughout the whole winter, which circumstances, combined with deficient depths in the bar-channel, prevented the contractor procuring an adequate supply of stone from the North.

For these reasons, and at the contractor's request, the Department granted an extension of time in which to complete his work from June 30 to October 31, 1883.

The scour on both sides of the south jetty, already referred to in my last annual report, greatly increased in violence and damaging effects from June 30 to November 15, 1882, during which time no mattresses could be sunk. When operations were resumed, the jetty was found to have settled considerably at several points. During winter and early spring the progress made was slow and unsatisfactory, frequent annoying delays being caused by stormy weather, and by the impossibility of obtaining sufficient quantities of stone. During that period the jetty continued to settle, especially where it is crossed by the old south channel, from 1,900 to 2,500 feet from the angle of junction with the shore branch, and between spurs Nos. 2 and 3, about 1,250 feet from the same point. At many points of the section first named the top of the jetty

settled below where the bottom was in the summer of 1881, when the bottom course was laid. Between spurs 2 and 3, where in June, 1882, the crest of the work reached to within 2 feet of the low-water line, it had dropped last winter at some points as low as 15 feet below that level. Toward the end of November, 1882, a portion of the shore branch sank from 5 to 6 feet in one night. On both sides of the jetty, particularly at the low places of the main line just referred to, the depth of water had greatly increased. To stop further excavation by scour, the revetting mats were laid as stated above, and a beginning was made with building up those portions of the jetty that had settled. The sunken parts of the shore branch were raised to a height of about 2 feet above low water, and for about 1,000 feet the main line, beginning at the angle of junction, was raised to the level of low water. For reasons given, the measures needed for arresting the scour and raising the jetty could not for several months be carried on with the energy and dispatch that were required by the urgency of the case, but during the last three months the progress made was more satisfactory.

During the past fiscal year riprap stone to an aggregate amount of $13,100.25 cubic yards was deposited on the south jetty.

OPERATIONS CONTEMPLATED DURING THE PRESENT FISCAL YEAR.

With the balance of $74,401.51 on hand on July 1, 1883, it is proposed to continue the work of raising the south jetty, and to take further measures for protecting it from undermining by scour during the approaching suspension of operations.

EFFECTS OF THE WORKS, AND CHANGES GENERALLY.

In rear of the land end of the north jetty, which originally was placed at the line of low water, a small channel about 70 feet wide has cut out, with 7 feet depth of water at low tide next to the first mattress and shoaling shorewards; in other words, the low-water line has receded here about 70 feet.

Upon the foundation mattresses of the outer half of the north jetty sand is accumulating rapidly. Ward's Bank has extended toward the present seaward end of the jetty.

At the land end of the south jetty and vicinity the low-water line receded a few hundred feet during a portion of the year; but in May and June last it again advanced, and is now in the same position approximately where it was a year ago.

Ward's Bank has been divided. The shoal near the wreck of the Lizzie Baker was, in October, 1882, found to have considerably washed out, and a channel seemed about to open in that direction; but in November following it had shoaled again, with not more than 1½ feet of water in it.

The rudimentary channel north of the south jetty, that had commenced forming, showed in last December a low-water depth of 5 feet near the seaward end of the jetty, diminishing to 1½ feet at a distance of 400 yards eastward and deepening again to 6 feet about 200 yards further out. At the close of the fiscal year it had about 2½ feet of water at the shoalest place. This channel occupies approximately the intended line of entrance. It is believed that it would now show better depths if the south jetty during last year had not settled to such a great extent, or if the damages could have been quickly repaired and the whole work pushed more rapidly seaward. A very large volume of water passes out through the deep gap in the south jetty where it

is crossed by the present sailing line. A considerable portion of this water requires to be deflected into the new ship-channel by filling up the gap.

Where the existing sailing line crosses the bar, there is now about 2 feet less water than there was a year ago.

Pelican Bank, to the south of the south jetty, has nearly disappeared.

NECESSITY OF AN EARLY APPROPRIATION.

The work of improving the mouth of Saint John's River has been for some time past, and is still, in a critical condition. Ample means should be furnished to proceed with the work, and to protect it thoroughly. The gap that has necessarily been left in the south jetty for the accommodation of vessels must be closed to establish the new ship-channel north of that jetty. This work, together with raising the jetty to the level of about 2 feet above low water, and extending it seaward, should be done as soon as possible, so as to secure sufficient depths in the new channel before the old sailing line ceases to be practicable.

For these reasons an early appropriation is greatly to be desired. The present funds will probably be exhausted by the end of October next. The total appropriations thus far made by Congress for this work amount to less than one-third of the estimate. In improving this locality, the ability to push the work with the utmost vigor is of the greatest importance. Of the entrances to harbors on the South Atlantic coast of the United States, now in course of improvement, the mouth of the Saint John's River has thus far presented the greatest and most perplexing difficulties, owing to the constantly shifting character of the bar, the material composing it being without stability and subject to sudden changes in position and depth from every storm occurring on this coast. The only practicable way for securing a permanent channel, at no exorbitant cost, consists in providing means on a liberal scale to raise and extend both jetties and hold them firmly in place, in order permanently to secure the improvement that is expected to result from their construction.

In view of the emergency of the case, it is earnestly recommended that the sum of $75,000 be appropriated for this work by a special act, said sum to be made available at an early date, so that operations can be resumed some time during the coming winter. There appears to be no doubt that the work will be left in a precarious condition when the balance of the last appropriation is expended under the existing contract.

In regard to the question of the amount of commerce and navigation to be benefited by the completion of the existing project, I beg leave to invite attention to the remarks made on the subject in my annual report for the fiscal year ending June 30, 1881. I will add that the trunk line now proposed to be built, and designed to form the shortest possible connection by rail between the Pacific and Atlantic oceans with Topolobampo on the Gulf of California, and Fernandina, Fla., on the Atlantic, as terminal points, and briefly referred to in my annual report of the improvement of the entrance to Cumberland Sound for the past fiscal year, would undoubtedly also give a powerful stimulus to the maritime commerce of Jacksonville, and to the navigation of the Saint John's River, provided a deep and permanent channel across the bar of that river is secured.

This improvement is located in the collection district of Saint John's. Jacksonville is the nearest port of entry.

Import duties collected during the calendar year 1882, $4,701.26.

The following appropriations have been made for this work since the present project of improvement was adopted:

By act of Congress approved June 14, 1880	$125,000
By act of Congress approved March 3, 1881	100,000
By act of Congress passed August 2, 1882	150,000
Total	375,000

The estimated cost of the improvement is $1,306.409.

The total expenditures to June 30, 1883, amounted to $300,598.49, including outstanding liabilities.

The following papers accompany this report:

Sheet 1.—Chart of entrance, showing progress of work and results of recent surveys.

Sheet 2.—Showing longitudinal section and cross-sections, and diagrams of widths of the south jetty.

Report of Lieut. W. T. Rossell, Corps of Engineers.

Table of commercial statistics furnished by the collector of the port.

Money statement.

July 1, 1882, amount available		$6,771 18
Amount appropriated by act passed August 2, 1882		150,000 00
		156,771 18
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$33,759 95	
July 1, 1883, outstanding liabilities	48,609 72	
		82,369 67
July 1, 1883, amount available		74,401 51
Amount (estimated) required for completion of existing project		931,409 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		600,000 00

Abstract of proposals for construction of jetties at mouth of Saint John's River, Florida, opened August 28, 1882.

No.	Names and addresses of bidders.	Mattresses.	Riprap stone.
		Per sq. yd.	*Per cu. yd.*
1	A. M. Newton, New York, N. Y	$1 25	$4 25
2	A. Ames Howlett, Syracuse, N. Y	65	3 25
3	Jos. H. Durkee, Jacksonville, Fla	75	4 00
4	Egbert L. Viele, New York, N. Y	1 00	3 90
5	Henry S. Pratt, Fayetteville, N. Y	1 20	3 88
6	Frank P. Murphy, Washington, D. C	99	3 79

Contract awarded to A. Ames Howlett, dated September 13, 1882; to commence September 25, 1882, and complete June 30, 1883.

REPORT OF LIEUTENANT WILLIAM T. ROSSELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Jacksonville, Fla., July 1, 1883.

COLONEL: I have the honor to submit the following report on the work done on the improvement of Saint John's River, Florida, during the fiscal year 1882–'83:

The project for the improvement of this river included the construction of converging jetties at its mouth. These are to be built of mattresses of logs, covered with brush and held in place by stone.

SHEET I.

IMPROVEMENT OF
ST. JOHN'S RIVER,
FLORIDA.

Showing the sites of the North and South Jetties, the progress made in their construction to June 30th 1883 and recent changes on the bar. From a survey recently made under the direction of

Colonel Q. A. GILLMORE, Corps of Engineers, U. S. A.

by

First Lieut. Wm. T. Rossell, Corps of Engrs., U. S. A.

assisted by

J. W. Sackett C. E.

Scale of Feet.

1000 500 0 1000 2000 3000

The soundings are expressed in feet and tenths and are reduced to the plane of mean low water.

The 6 feet curve is marked .....

The 12 feet curve is marked - - - - -

The 18 feet curve is marked — — — —

The 24 feet curve is marked ——————

Accompanying annual report of July 30. 1883. for the fiscal year ending June 30. 1883.

Q. A. Gillmore
Col. Engrs. Bvt. Maj. Gen. U.S.A.



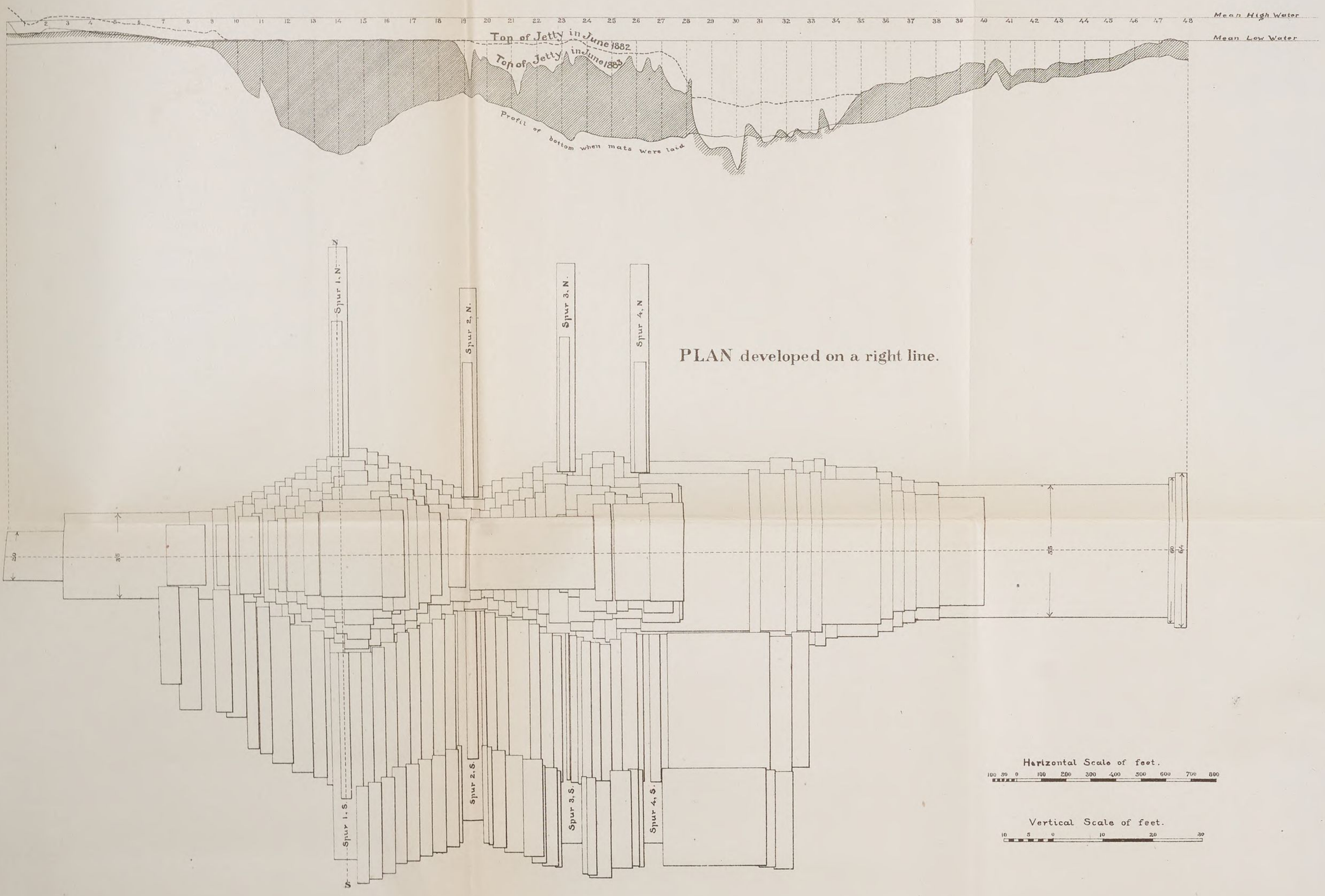
SHEET II.

IMPROVEMENT OF
ST. JOHN'S RIVER,
FLORIDA.

Showing section of the South Jetty
and a plan of the mattress at various points as built to June 30, 1883
Accompanying annual report dated July 30, 1883,
for the fiscal year ending June 30, 1883.

D. A. Gillmore
Col. Engrs. Bvt. Maj. Gen. U.S.A.

LONGITUDINAL SECTION



During previous years work has been done on both jetties as follows:

	Feet.
North jetty:	
Length of foundation course	1,115
South jetty:	
Length of foundation course	4,813
Length of second course	3,003
Length of third course	1,776
Length of fourth course	1,380
Length of fifth course	331
Length of spurs, first course	717
Length of spurs, second course	427
Total length of several courses and spurs	12,447

At the end of the fiscal year there remained to finish the contract of Mr. J. H. Durkee only a small amount of stone to be furnished. This was done in July, 1882, and amounted to 1,001.56 cubic yards. Under the appropriation for the year 1882–'83, a contract for jetty construction was made with Mr. A. A. Howlett. All the work under this contract, up to June 30, 1883, has been done on the south jetty, and has consisted in laying a revetment or apron on the south side of the jetty and in raising the jetty.

The revetment on the south side consists of the same mattresses, held in place by stone, as are used in the jetty. Its width from low-water mark to spur one south is one mattress; beyond this it is widened by another mattress. The mattresses nearest the jetty I have called revetment A and the others revetment B. Of the revetment A, the mattress nearest shore is 40 feet wide, the next three 50 feet wide, and all the rest 60 feet wide. The revetment B mattresses are all 40 feet wide.

During the year work has been done as follows:

	Feet.
Length of revetment A	2,112.8
Length of revetment B	1,509.0
Length of second course on jetty	206.3
Length of third course on jetty	85.0
Length of fourth course on jetty	164.0
Length of fifth course on jetty	986.0
Length of sixth course on jetty	550.5
Length of seventh course on jetty	127.0
Total length of the several courses and revetments	5,740.6
Total previous years	12,447.0
Total of several courses, spurs, and revetments to June 30, 1883	18,187.6

As mentioned in the Annual Report of 1882, a considerable scour was observed on both sides of the south jetty, and the spurs were built to arrest this. It was also stated that the scour on the south side was principally due to the fall of the water passing over the jetty. It was with a view of stopping this scour that, by your direction, the south revetment was laid.

As the last mattress under Mr. Durkee's contract was laid on June 30, 1882, and the first one under Mr. Howlett's contract was not laid until November 15, 1882, the scour had increased greatly and the jetty had settled considerably. Even after work began unexpected difficulty in getting stone in sufficient quantity caused delays. Time was of paramount importance, yet the work moved slowly, while every day increased the scour. The worst place in the jetty is between spurs 2 and 3. At this place we now find on the north side of the jetty 42 feet of water and on the south side 54 feet at mean low water. At this place four courses of mattresses had been sunk in previous years, yet the jetty sunk until its top was below where the bed had been.

The low-water line reached nearly 100 feet, and near shore the jetty suddenly sank 6 feet in one night. Great difficulty was found in sinking the revetment mattresses in the very deep water on account of the unevenness of the bottom and the perplexing eddies. As soon as the revetment had been laid beyond the place where the ship-channel crosses the jetty, by your direction, the jetty was raised to the level of mean low water, commencing in-shore and going out. This has now been done as far as spur 2. Wherever there was sufficient water to prevent wood from showing at low water, mattresses were used. Between spurs 2 and 3 three courses of mattresses have been laid, and between spurs 3 and 4 one course.

I would particularly call attention to the cross-section of the jetty taken between spurs 2 and 3. Here are seven courses, the top three 30 feet wide, very deep water on both sides; this I think without doubt the weakest point in the jetty. Beyond this no mattresses have been laid on the axis. Here in the ship-channel the jetty has sunk badly, as may be seen in the longitudinal section. This settlement has all taken place since January, 1883.

The scour on the north side of the jetty was arrested by the spurs, but when the tremendous settlement took place between spurs, they (the spurs) merely seemed to act as guides to the current.

Could the work go on rapidly and the jetty soon be raised, as you directed, to 2 feet above mean low water, I think the work would be safe. When the tide begins to fall the current continues to flow inward for some time and the ebb does not reach a great velocity until the tide has fallen somewhere about 2 feet. Thus, were the jetty of this height it would cut off nearly all the fall of water over it on the ebb.

When the work was done on the north jetty it was started from low-water line. During the past year a small channel has cut through to the westward of the jetty, so that the west end is about 70 feet from low-water line and lies in water about 6 feet deep at mean low water. When this channel first began to cut, I was directed by you to watch this, and, if it were necessary, to build the jetty to the high-water mark.

In view of the condition of the south jetty and the small extent of the trouble on the north jetty, this work was not considered advisable. But I would recommend that this be built to high-water mark, as soon as the work on the south jetty can be safely left.

Many changes will be noticed on the chart from last year. Pelican Bank has almost disappeared; Ward's Bank has been divided and a new channel passes to the sea, north of the south jetty. The low-water line has receded near the north jetty, but near the south jetty is not far from where it was last year—it has built out in the last two months.

Over the present sailing line there is about 2 feet less water than there was over the bar last year.

In December, 1882, the channel over the bar began shoaling and apparently a new channel was about to cut out between the jetties, in or near the position marked on the chart by a line of soundings. It was hoped to hasten the formation of this new channel, and I was authorized to hire a tug to stir up the sand on the ebb tide with its wheel. I could, however, find no tug willing to take the risk.

Early in January, 1883, the United States dredge steamer Henry Burden was sent here and remained until May 19, when, by your direction, she returned to Savannah.

As there was not sufficient water for her to work in the new channel, I put her to work in the sailing channel, which she deepened somewhat, allowing vessels to go out that had been detained here for more than forty-five days.

I then made the attempt to deepen the new channel by dragging chains through on the ebb with the steam-launch Ariel. In this I was so far successful as to allow the *Burden* to get through. By both *Burden* and *Ariel* a channel was formed with 5 feet of water at mean low water and a width of about 200 feet. No increase, however, beyond this could be obtained. Since then this channel has shoaled until there is only 2.5 feet of water at mean low water. This has been due to easterly winds and also to another break in Ward's Bank still farther to the north, as may be seen on the chart.

Accompanying this report I send two sheets of drawings: A chart of the river near the jetties and plans; longitudinal and cross-sections of the jetties.

* * * * * * *

I am, very respectfully, your obedient servant,

WM. T. ROSSELL,
First Lieutenant of Engineers.

Col. Q. A. GILLMORE,
Corps of Engineers, U. S. A.

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels at Jacksonville, Fla., from January 1, 1878, *to December* 31, 1882.

VESSELS ARRIVED.

Years.	Coastwise.			American vessels from foreign ports.			Foreign vessels from foreign ports.			Total.		
	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.
1878	235	92, 267	2, 917	19	2, 979	118	10	653	56	264	95, 899	3, 091
1879	335	170, 872	5, 172	17	3, 008	108	23	12, 948	558	375	186, 829	5, 838
1880	353	161, 039	4, 487	21	4, 019	136	9	673	57	383	165, 731	4, 680
1881	408	150, 430	4, 169	19	3, 161	134	10	665	62	437	154, 256	4, 365
1882	376	116, 829	3, 149	11	5, 183	155	22	1, 501	140	409	123, 513	3, 444

VESSELS CLEARED.

Years.	Coastwise.			American vessels for foreign ports.			Foreign vessels for foreign ports.			Total.		
	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.	Number of vessels.	Tonnage.	Crew.
1878	245	94, 732	5, 838	34	6, 076	214	10	678	61	289	101, 486	6, 113
1879	335	169, 949	5, 077	34	5, 839	211	21	12, 908	559	390	188, 696	5, 847
1880	363	158, 733	4, 346	45	13, 526	428	10	716	72	418	172, 975	4, 846
1881	420	150, 494	4, 281	26	5, 547	192	11	950	76	457	156, 001	4, 540
1882	365	114, 741	2, 892	30	8, 687	277	22	1, 470	163	417	124, 898	3, 332

Years.	Value of exports.	Value of imports.	Duties collected.
1878	$74, 035 47	$1, 363 27	$181 52
1879	92, 890 84	15, 319 26	771 21
1880	94, 680 00	888 40	98 91
1881	62, 265 07	2, 380 08	230 03
1882	68, 583 84	12, 542 51	4, 701 26

JOS. E. LEE,
Deputy Collector.

SPECIAL REPORT OF CAPTAIN JAMES C. POST, CORPS OF ENGINEERS, DATED JANUARY 11, 1883.

[Called for by Senate resolution of January 2, 1883, and printed in Senate Ex. Doc. No. 49, Forty-seventh Congress, second session.]

The project for improving the mouth of the Saint John's River, Florida, as submitted by Col. Q. A. Gillmore, Corps of Engineers, in his annual report to the Chief of Engineers, dated June 30, 1879, and printed with Appendix I 7 of the Annual Report of the Chief of Engineers of 1879, contemplates the construction of two long jetties from the opposite shores of the entrance, and extending seawards across the bar. It is expected that by these works a mid-channel depth of 15 feet can be obtained through the bar, at an estimated cost of $1,306,409. The jetties were to be built of riprap stone, supported by a foundation mattress of logs, with a mattress hearting wherever found practicable.

The appropriations thus far made by Congress for this improvement aggregate $375,000.

Operations were first commenced in December, 1880. The foundation course of the south jetty has now reached a length of 4,813 feet from shore; for considerable portions of this length it is overlaid with from one to four additional courses of log mattresses and riprap stone. The length of the apron or bottom course of the north jetty is at present 1,115 feet.

In his last annual report of operations at the mouth of the Saint John's River, for the fiscal year ending June 30, 1882, Colonel Gillmore states that—

> Considerable scour having been developed on both sides of the south jetty during the past fiscal year, which ultimately might threaten the stability of the work, eight spur jetties were constructed, four on each side, opposite to each other.

In referring to the condition of the work toward the latter part of the month of June, 1882, Colonel Gillmore reported that both jetties were

in a good condition generally, and that on the main line of the south jetty no settlement had been noticed except in a slight degree in the heavier part, which was ascribed to the gradual compacting of the several courses; that the shore end of the jetty had settled from 1 to 4 feet on a portion of its length, which was undoubtedly caused by the little rivulet known as South Run that crossed this line of the jetty obliquely, and produced underscour. Nearly 2 feet of sand had at that time collected over the first or shore mattress of the north jetty.

Operations were suspended in July, 1882, from lack of funds. When the last appropriation of $150,000, made by act passed August 2, 1882, became available, proposals for continuing the work were invited, and a new contract was subsequently made, under which operations were resumed in November last.

It was found that in the mean time the scour had greatly increased in strength and effects along both sides of the south jetty, which has at some places, where it had been built up highest, settled as much as 9 feet. The settling of the shore end of this jetty had also continued, and the low-water line receded inshore some 250 feet. The beach at the shore end of the north jetty has also washed away, and a channel has been formed, through which a strong tide is running. Had additional money been available so as to have prevented the long period of suspension of operations, nearly if not quite all of this settlement could have been prevented. Precautionary measures were taken to the full extent that the funds would allow before the last appropriation was exhausted. Suitable means are now being taken to repair these damages and to prevent further encroachments upon the jetties and the shore. It is evident from the shifting, unstable nature of the material forming the sea bottom at the mouth of this river, that particular care is needed to secure the safety and stability of the work, which just now is passing through a critical period. To insure this it is necessary, especially at this time, that funds should be continually on hand which can be applied as required from time to time to check any tendencies of action that would be detrimental to the work. There seems to be no necessity for making an immediate appropriation for this improvement, since the last appropriation will probably not be expended before the end of the present fiscal year, when, under the terms of the contract, the latter will be completed; but if the work is to be secured and economically completed the appropriations should be such as to allow it to go on continuously.

The balance of the last appropriation, still available at this date, will probably during the next six months have been expended entirely, or nearly so, in repairing, protecting, or strengthening what has been thus far constructed, and in making further efforts towards developing the formation of a new and improved ship-channel on the line selected for it north of the south jetty.

In view of the present rather critical state of the work, it is desirable that an early additional appropriation should be made, so as to have the means on hand, during the next fiscal year, to counteract at once further inroads of the sea, and to take advantage of such times when the weather is favorable to a further extension of the jetties. Colonel Gillmore estimates in his last annual report that the sum of $600,000 can be profitably expended in the fiscal year ending June 30, 1884; an amount which would permit a very vigorous prosecution of operations, and would most probably result in a more favorable contract than under a comparatively small appropriation.

L 14.

IMPROVEMENT OF VOLUSIA BAR, FLORIDA.

By act of Congress passed August 2, 1882, the sum of $5,000 was appropriated for continuing the work of improving Volusia Bar, Florida. Two appropriations, aggregating $10,500, had been made by previous acts of Congress.

Volusia Bar is located at the south end of Lake George, about 162 miles by river from the mouth of the Saint John's River, at the point where the waters of the river discharge into the lake.

By the river and harbor act of June 18, 1878, it was provided that an examination or survey should be made of the Saint John's River, Florida, between Lake George and Lake Monroe, and estimates of cost of deepening Volusia Bar and of straightening the river by cut-offs. An examination and partial survey of the locality indicated was made under my direction in March, 1879.

PROJECT OF IMPROVEMENT.

A project for permanently improving Volusia Bar by means of two jetties, with a view of establishing a channel depth of 6 feet, was submitted with my report of the examination dated July 16, 1879, printed as Appendix I 9, Annual Report of the Chief of Engineers for 1879. Heretofore the low-river depth on the bar has not exceeded $3\frac{1}{2}$ to $4\frac{1}{2}$ feet.

The cost of the project was estimated at $15,000.

WORK DONE PRIOR TO JULY 1, 1882.

The west jetty, bearing north, 25 degrees west, had reached a length of 2,206 feet from shore. For the greater part of its length it consists of a single or bottom course of pole-and-brush mattresses, varying from 6 to 12 feet in width, and loaded with broken stone. A second course of mattresses, 6 feet wide, covers 159 linear feet of the outer portion of the work.

The east jetty, bearing north 76 degrees west, is placed with its shore end about 2,400 feet east of that of the west jetty. Its bottom course, 6 feet in width, was built to a length of 1,836 feet from shore.

One hundred and seven piles were driven, of which 100 were placed in clusters of three and four, in two rows 75 feet apart, through which space steamboats are compelled to pass. These rows extend each over a length of more than 800 feet; they run about parallel to the outer end of the west jetty. The row of piles nearest to that jetty is about 100 feet east of it.

OPERATIONS DURING THE LAST FISCAL YEAR.

The work during the past fiscal year was done by means of the appropriation of $5,000, made by act passed August 2, 1882.

Proposals for expending that sum, by furnishing and putting in the work, pole-and-brush mattresses, riprap stone, and fender-piles, were invited in the usual way. Of two bids received and opened on September 25, 1882, one made by Mr. G. A. De Cottes, of Brooklyn, N. Y., was the lowest. He asked 95 cents per square yard for mattress, $5.95 per cubic yard for stone, and $6 per pile. A contract was made with him on these terms on October 23, 1882.

Under this contract the east jetty was extended to the bar by adding 1,622.7 linear feet of work to the previous length. Its outer end is now nearly abreast with that of the west jetty. A length of about 1,100 feet of the above length is laid on a range bearing north 63 degrees west; the balance, which embraces the outer portion of the jetty, is placed about parallel to the west jetty, and 240 feet from it. The width of the mattresses that were used varies from 6 to 12 feet. A length of 247 linear feet of the extreme outer end is composed of two courses of mattresses, the balance of a single course, all ballasted with riprap stone.

Forty-three new guide or fender piles were driven, and seventeen old ones that had been broken or forced out of position by passing boats were removed.

CONDITION AND EFFECTS OF THE WORK.

Both jetties have settled somewhat over portions of their lengths. Otherwise they are in good condition. The bar has caused no trouble or delay during the past year. The minimum depth over it, however, was occasionally but 4.7 feet, which at other times was over 5 feet. The shoaling is generally caused by deposits made when the river is at its flood stages, which are removed by the current when the river falls.

To permanently secure the proposed low-water channel of 6 feet depth on Volusia Bar, and to prevent, if possible, the formation of a new bar further north, will require some additional work. On this subject I said in my last annual report:

> It is probable that the original estimate will be somewhat exceeded in completing the improvement, since the jetties will be longer than first calculated, and their outer portions will be higher and consume more material, being located in water from 5 to 7 feet deep. The piles lately driven formed no part of the original project. Some dredging may also have to be done.

For the reasons here given, and also owing to the fact that the sum originally estimated to be required was not furnished in bulk, but in three small appropriations by which the cost of the work was increased, more funds are needed.

It is estimated that an additional sum of $6,100 will be sufficient to complete the project, and it is recommended that this amount be appropriated by Congress.

I have obtained no new data relating to the amount of commerce and navigation that would be benefited by the completion of the improvement of Volusia Bar, and beg leave to refer to the remarks made on the suject in my annual report to the Chief of Enginers for 1881.

This work is located in the collection district of Saint John's. Jacksonville is the nearest port of entry.

Amount of duties collected in 1882, 4,701.26.

Since the work of improvement was commenced, the following appropriations have been made:

By act of Congress approved June 14, 1880	$5,000
By act of Congress approved March 3, 1881	5,500
By act of Congress passed August 2, 1882	5,000
Total	15,500

Of this amount there has been expended to the close of the fiscal year ending June 30, 1883, including outstanding liabilities, the sum of $14,989.04.

The following papers are transmitted herewith:

Report of Lieut. W. T. Rossell, Corps of Engineers.
Chart of Volusia Bar, showing sites of jetties.

CHART
OF
VOLUSIA BAR, FLORIDA.

Showing location and progress of work of improvement to June 30th 1883.

Under the direction of

Colonel Q. A. Gillmore, U.S. Corps of Engineers., Bvt. Maj. Gen. U.S.A.

First Lieut. W. T. Rossell, U.S. Corps of Engineers, in local charge.

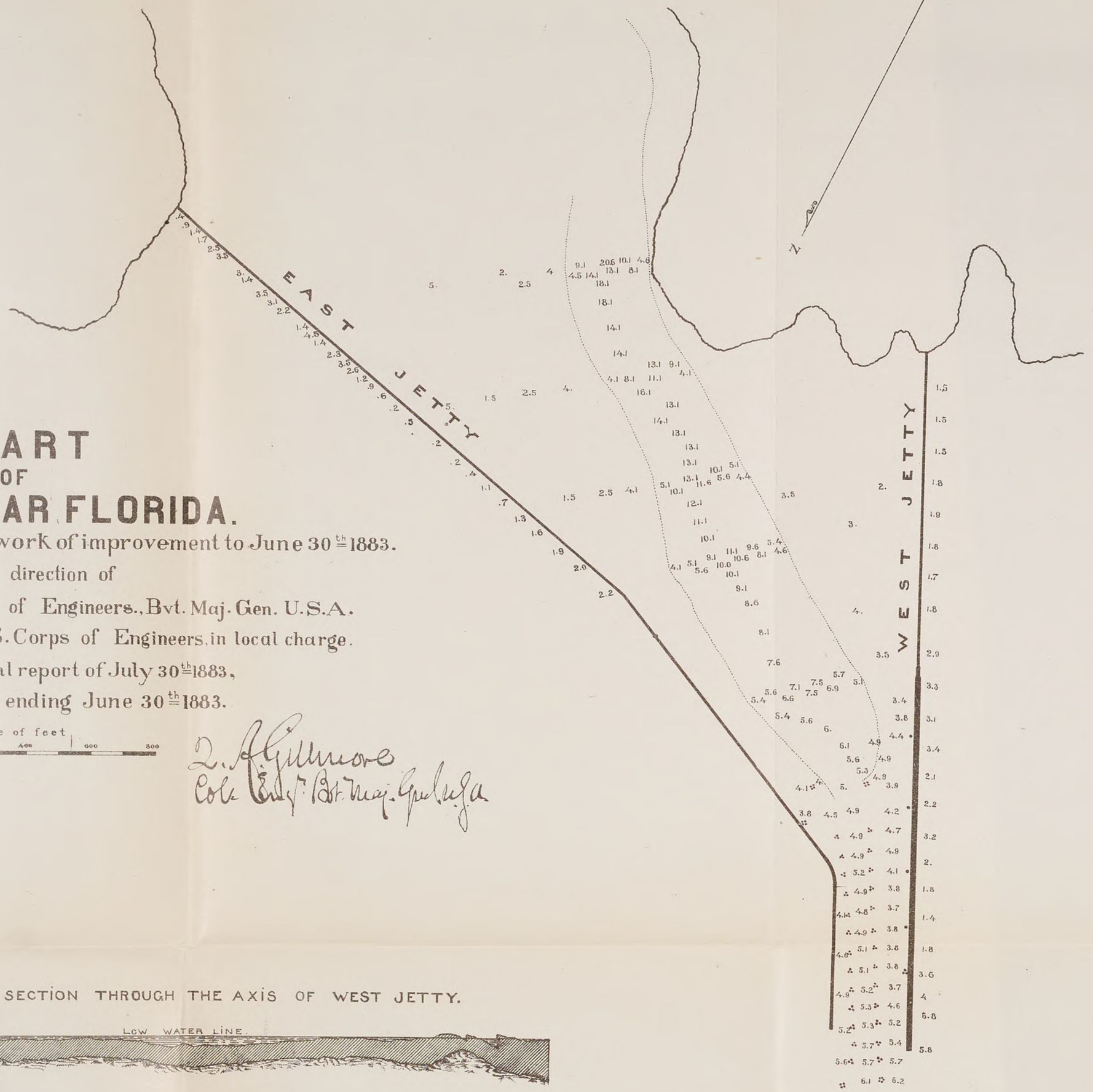
Accompanying annual report of July 30th 1883,

for the fiscal year ending June 30th 1883.

Scale of feet

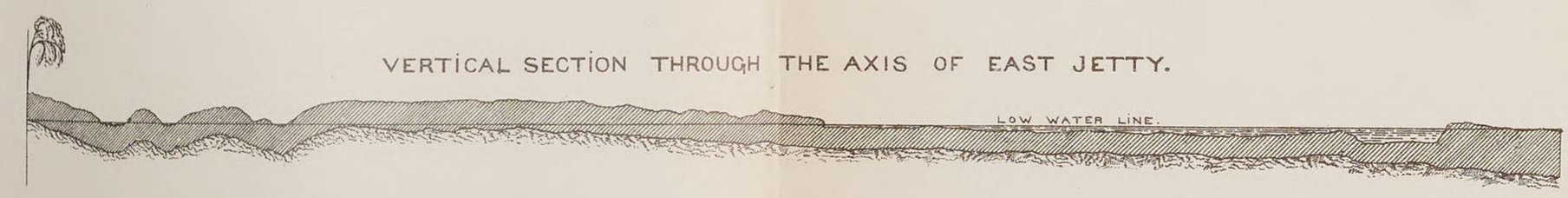
100 0 100 200 400 600 800

Q. A. Gillmore
Col. Engrs. Bvt. Maj. Genl. U.S.A.



VERTICAL SECTION THROUGH THE AXIS OF WEST JETTY.

VERTICAL SECTION THROUGH THE AXIS OF EAST JETTY.



Scale of heights

10 5 0 10 20

Money statement.

July 1, 1882, amount available	$66 00
Amount appropriated by act passed August 2, 1882	5,000 00
	5,066 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4,555 04
July 1, 1883, amount available	510 96
Amount (estimated) required for completion of existing project	6,100 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	6,100 00

Abstract of proposals for constructing jetties at Volusia Bar, Florida, opened September 25, 1882.

No.	Names and addresses of bidders.	Mattresses.	Riprap stone.	Piles driven.
		Per sq. yd.	*Per cu. yd.*	*Each.*
1	George A. De Cottes, Jacksonville, Fla	$0 95	$5 95	$6 00
2	L. A. Cunningham, Batavia, N. Y	1 05	7 25	12 00

Contract awarded to George A. De Cottes; work completed March, 1883.

REPORT OF LIEUTENANT WILLIAM T. ROSSELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Jacksonville, Fla., July 1, 1883.

COLONEL: I have the honor to submit the following report of operations on the improvement of Volusia Bar, Florida, during the fiscal year ending June 30, 1883.

The project for the improvement of this bar included the construction of converging jetties, built from the banks of the river into Lake George. The position of the bar is just where the Saint John's River begins to widen into the lake.

At the beginning of the past fiscal year, July 1, 1882, the west jetty had been built as far as projected into 6 feet of water at low water—its length being 2,206 feet. The east jetty had been built a length of 1,836 feet. In addition to these jetties two rows of guide piles were driven, the piles being in clusters of three and four; the rows were about 75 feet apart and on opposite sides of the channel. They were driven with the design of forcing steamers to use the channel between them. It was hoped by this means to avoid any shoals forming, as the steamers themselves would stir up the sand and thus facilitate its removal by the current.

Under the appropriation for the past fiscal year the east jetty has been extended a distance of 1,622.7 feet. It was constructed of brush mattresses held in place by stone, in all respects as described in the annual report of 1882.

Of the jetty built in 1882–1883, the width of mattresses and depth of water varied as follows: 1,184.4 linear feet—mattresses 6 feet wide—depth of water varying from 2.2 feet to 4.0 feet at low water, 191.3 linear feet; mattresses 9 feet wide, depth of water varying from 4.0 feet to 4.5 feet at low water, 247.0 linear feet. Mattresses made double the bottom course 12 feet wide with a second course 6 feet wide, depth of water varying from 4.5 feet to 5.3 feet at low water.

PRESENT TOTAL LENGTH.

	Feet.
East jetty	3,458.7
West jetty	2,206.0

At the beginning of the year many of the piles in the rows of guide piles had been knocked down or forced out of position; during this year these have all been replaced by new piling and all the clusters have been securely fastened by chains. Forty-three new piles were driven and seventeen old ones removed.

An examination of the work made in April, 1883, shows both jetties to stand well. A slight settlement has taken place, but the work is well sanded, and appears in excellent condition.

I send with this report a chart of the site and diagrams showing plans and longitudinal and cross sections of the jetties.

This chart shows less water over the bar by four-tenths of a foot than last year in June. It should be noticed, however, that the charts were made at different times of the year and when the river was at different levels. When the river, in April, 1882, was at the same level nearly as at the time when the present chart was made, the inspector's reports show 4.9 feet at low water over the bar.

But when the chart of 1882 was made the river had fallen. Now, this bar fills at the high stages and cuts out at the low stages of the river. This has not, I think, been changed by the construction of the jetties, but they cause the current to bear on the channel so promptly that sufficient depth is kept at all stages.

No trouble or delay has been caused by the bar during the past year, and the depth of water below low water has at no time been less than 4.7 feet.

The danger to be apprehended, should anything happen, is that a shoal might form further out in the lake, or the jetties might settle and need to be raised.

I think the rows of guide-piles should be kept up, and if a small amount of money could be obtained for this it would be all that would be necessary.

The country benefited by this improvement comprises at least eight large counties of the State of Florida. These counties are every year being opened and settled. Three lines of large steamers make regular trips through this channel, there being from three to six steamers passing through every day during the winter season, and during the summer from two to three. These steamers connect with railroads leading from Astor to Fort Mason, 28 miles long, and from Sanford to Kissimmee City, 40 miles long.

* * * * * * *

Very respectfully, your obedient servant,

WM. T. ROSSELL,
First Lieutenant of Engineers.

Col. Q. A. GILLMORE,
Corps of Engineers, U. S. A.

L 15.

IMPROVEMENT OF SAINT AUGUSTINE'S CREEK (THUNDERBOLT RIVER), GEORGIA.

Of the sum of $5,000, appropriated by act of Congress approved March 3, 1879, $1,582.34 were expended during the fiscal year ending June 30, 1881, in the partial removal of the wreck of a large timber dry-dock, which was sunk in the middle of the stream during the late civil war.

There appears to be no necessity for any further improvement of the river at this point, and no appropriation is asked.

This work is located in the collection district of Savannah. Savannah is the nearest port of entry.

Amount of import duties collected in 1882, $61,148.70.

Money statement.

July 1, 1882, amount available	$3,417 66
July 1, 1883, amount available	3,417 66

L 16.

IMPROVEMENT OF INSIDE PASSAGE BETWEEN FERNANDINA AND SAINT JOHN'S RIVER, FLORIDA.

Appropriations for the improvement of this route, aggregating $78,000, were made at various times between the years 1828 to 1838. A further appropriation of $10,000 was made in 1874, and two others, of $7,000 each, by the acts approved March 3, 1879, and June 14, 1880, respectively.

Only $2,565.55 of the amount last appropriated had been expended when work was suspended. As suggested in my last annual report, the recently completed direct line of railway between Fernandina and Jacksonville and the improvement of the bar at the mouth of Saint John's River afford passengers and freight a choice between transit by rail and transit by sea and river by coasting steamers, and the necessity for continuing the improvement of this inside passage is, therefore, not urgent at the present time; still the inside passage between Savannah and Jacksonville, which actually continues far into the interior of Florida, by means of the Saint John's River, may be considered as a valuable water route for many purposes.

Its importance in the case of the United States becoming involved in war with a maritime power has been pointed out in former reports.

Its improvement when undertaken should be on a liberal scale.

The following appropriations have been made for this work since 1874:

By act of Congress approved June 23, 1874	$10,000
By act of Congress approved March 3, 1879	7,000
By act of Congress approved June 14, 1880	7,000
Total	24,000

The total expenditures since 1874, including the cost of the survey, were $19,565.55.

This inland route is partly in the collection district of Fernandina and partly in that of Saint John's, of which Fernandina and Jacksonville are the respective ports of entry.

Money statement.

July 1, 1882, amount available	$4,434 45
July 1, 1883, amount available	4,434 45

L 17.

REMOVAL OF SUNKEN VESSELS OBSTRUCTING OR ENDANGERING NAVIGATION.

The wreck of the United States transport steamer Maple Leaf, referred to in my last annual report as forming an obstruction to navigation in Saint John's River, near Mandarin Point, 15 miles above Jacksonville, was removed during the past fiscal year to a low-water depth of 19 feet. This was done under the provisions of section 4 of the act of Congress approved June 14, 1880, and for the price of $3,800, as stipulated in a contract made with Mr. R. G. Ross, of Fernandina, Fla. The work had been advertised in the usual way, and of three bids received, that made by Mr. Ross was the lowest. The expenses for advertising, inspection, &c., amounted to $172.79, making the total cost $3,972.79.

Abstract of proposals and contract for removal of wreck and cargo of steamer Maple Leaf from the Saint John's River, Florida, opened September 30, 1883.

No.	Names and addresses of bidders.	Price.	Date of commencement.	Date of completion.
1	J. A. Cloud, New York, N. Y	$4,890	Nov. 5, 1882	In 90 days.
2	Samuel R. Cumming, New York, N. Y	14,250	.....	.....
3	Roderick G. Ross, Fernandina, Fla	3,800	.....	.....

Contract awarded to Roderick G. Ross at the price stated, the work to be completed by February 1, 1883.

APPENDIX M.

IMPROVEMENT OF THE HARBORS OF MOBILE, ALABAMA, AND KEY WEST AND PENSACOLA, FLORIDA; OF TAMPA AND APPALACHICOLA BAYS, FLORIDA, AND OF CERTAIN RIVERS IN GEORGIA, ALABAMA, FLORIDA, AND MISSISSIPPI, EMPTYING INTO THE GULF OF MEXICO.

REPORT OF MAJOR A. N. DAMRELL, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1883, *WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

1. Mobile Harbor, Alabama.
2. Pensacola Harbor, Florida.
3. Key West Harbor, Florida.
4. Chattahoochee River, Georgia and Alabama.
5. Flint River, Georgia.
6. Appalachicola River, Florida.
7. Appalachicola Bay, Florida.
8. Tampa Bay, Florida.
9. Suwanee River, Florida.
10. Choctawhatchee River, Alabama and Florida.
11. Cahaba River, Alabama.
12. Tallapoosa River, Alabama.
13. Old Town Creek, Mississippi.
14. La Grange Bayou, Florida.
15. Withlacoochee River, Florida.
16. Caloosahatchee River, Florida.
17. Peas Creek, Florida.
18. Escambia River, Florida.
19. Escambia and Conecuh Rivers, Florida and Alabama.
20. Alabama River, Alabama.
21. Warrior and Tombigbee Rivers, Alabama and Mississippi.
22. Tombigbee River above Columbus, Mississippi.
23. Noxubee River, Mississippi.
24. Pascagoula River, Mississippi.
25. Manatee River, Florida.
26. Roadstead leading into Back Bay of Biloxi, Mississippi.

UNITED STATES ENGINEER OFFICE,
Mobile, Ala., August 3, 1883.

SIR: I have the honor to forward herewith annual reports for the year 1882–'83, for the river and harbor improvements under my charge.

Very respectfully, your obedient servant,

A. N. DAMRELL,
Major of Engineers.

To the CHIEF OF ENGINEERS, U. S. A.

M 1.

IMPROVEMENT OF THE HARBOR AT MOBILE, ALABAMA.

The improvement of the channel of the harbor at Mobile was begun in 1827, the depth being at that time 5½ feet through Choctaw Pass and 8 feet on Dog River Bar.

Up to 1857 the amount of $228,830.68 had been appropriated, as follows:

By act of Congress May 20, 1826	$10,000 00
By act of Congress March 2, 1829	20,000 00
By act of Congress June 23, 1834	10,000 00
By act of Congress March 3, 1835	17,997 60
By act of Congress, date not given, 1837	50,000 00
By act of Congress, date not given, 1838	50,000 00
By act of Congress August 30, 1852	50,000 00
	207,997 60
By act of Congress March 3 (relief claim), 1857	20,833 08
Total	228,830 68

The result obtained was a channel 10 feet deep and 200 feet wide through the "pass" and the dredging of a channel 10 feet deep, with an unknown width, through Dog River Bar.

In 1860 the cut through the pass was found to have shoaled to 7½ feet, while that through Dog River Bar, remained unchanged. No further improvement was attempted until 1870.

From 1870 to 1875 the following appropriations were made:

By act of Congress July 11, 1870	$50,000
By act of Congress March 3, 1871	50,000
By act of Congress June 10, 1872	75,000
By act of Congress March 3, 1873	100,000
By act of Congress June 23, 1874	100,000
By act of Congress March 3, 1875	26,000
Total	401,000

The work accomplished was a channel 13 feet deep, 300 feet wide, from the mouth of Mobile River through Choctaw Pass, and a channel of same depth, but with a width of 200 feet, through Dog River Bar, having the southern entrance at the 13-foot curve, about 8½ miles from the mouth of the river.

From 1875 up to the commencement of the present improvement there was no perceptible change in the depth along the entire length of channel.

From 1878 to June 30, 1883, the following appropriations were made:

By act of Congress June 18, 1878 (survey)	$10,000
By act of Congress March 3, 1879	100,000
By act of Congress June 14, 1880	125,000
By act of Congress March 3, 1881	100,000
By act of Congress August 2, 1882	125,000
Total	460,000

In 1878 a survey, also tests and borings, were directed to be made in order to determine whether the then existing 13-foot channel could be so deepened and depth maintained as to admit to the wharves of the city vessels drawing not more than 22 feet, and for this purpose the sum of $10,000 was appropriated (see preceding table).

From the results of the survey and borings a report was submitted to the Chief of Engineers, suggesting several plans of improvement.

It was finally decided to continue the improvement by dredging to the depth of 17 feet with a uniform width of 200 feet (following the existing 13-foot channel), the estimated cost being $820,000.

Three alterations have been made in the original project:

(1.) On account of the sharp bend and swift current at the mouth of the river the width of the channel will be increased for a distance of 3,820 feet to 300 feet, and through the upper gap of the obstructions to

400 feet, for 1,000 feet; thence to the lower gap of the same, for a distance of 4,703 feet, the width will be 250 feet.

(2.) In order to straighten the channel as much as possible the line of the 13-foot channel (south 11 degrees east, magnetic) was continued to a point just south of Fowl River Shoals, 16.44 miles distance from the upper entrance. At this point an angle of 12 degrees 40 minutes to the right was made, and the channel (south 1 degree 40 minutes west magnetic) so located that the extreme northern point of the 22-foot curve was reached instead of that of the 17-foot curve, thus obviating any further change of direction should the depth at any future time be increased to 22 feet.

(3.) The mean low gauge of 7.2 feet, as established prior to the commencement of the work, while being correct for the entire year, is not true for the winter or business season of this port, and it was deemed advisable to change the gauge from 7.2 feet to 6.2 feet, so that when the gauge at Battery Gladden should record 6.2 feet depth, there would be in the channel 17 feet of water during the winter months. This change necessitated dredging 1 foot deeper than was intended in the original project.

The condition of the channel previous to the commencement of the present improvement was such that vessels drawing over 12½ feet could not reach the wharves of the port or ascend the bay beyond the lower anchorage, 28½ miles distant, at ordinary stage of water. From the mouth of Mobile River to Fowl River Shoals (except between the obstructions) the depth of water in the channel nowhere exceeded 13 feet, being uniformly of this depth until the above shoals (16.44 miles distant from the mouth of the river) were reached, where the depth varied from 12 feet to 13 feet at mean low stage of tide.

From this point a plateau with 13½ feet depth of water extended to within 4 miles of the southern entrance of the projected channel, and then the depth gradually increased to 17 feet.

The nature of the material to be dredged is hard compact sand about 2½ feet thick overlying a stiff blue clay more or less mixed with sand in the mouth of the river; in Choctaw Pass the material is the same as in the river without the top layer of sand; from the obstructions to a point east of Dog River the material is a stiff blue clay, comparatively free from sand or alluvial deposits. Dog River Bar is the same, covered, however, with a layer of compact sand from 6 inches to 2½ feet thick; from this point to Fowl River Shoals the material is a stiff blue clay entirely free from sand. The shoals are composed of oyster reefs, the ridges here and there cropping out and covered between with clay mixed with small shell; from Fowl River Shoals to the 17-foot curve the material is a very soft blue mud.

Congress in 1879 having appropriated $100,000 for this improvement, bids were called for and opened May 20, 1880, resulting in the rejection of all as too excessive (the lowest being 24.9 cents) and the work ordered to be readvertised. Congress in 1880 appropriated an additional $125,000; bids were, therefore, called for on a basis of $225,000, and the contract was awarded to George C. Fobes & Company, of Baltimore, Md., their bid (12.3 cents per cubic yard) being the lowest.

The contractors commenced work February 19, 1881, and completed their contract November 9, 1882, dredging portions of Cuts 1, 2, 3, 4, 5, 6, and 7, which reduced to a single cut of 35 feet width 42.25 miles in length, removing, according to terms of contract, 1,610,804 cubic yards of material. The contract was completed in one year, eight months, and twenty days from time of commencement.

Congress appropriated in 1881 the sum of $100,000, and the contract

was awarded July 9 to Mr. G. L. Long, of Mobile, Ala., at 11.7 cents per cubic yard.

The contractor commenced work March 21, 1882, and completed same January 24, 1883, dredging portions of Cuts 1, 2, 3, and 4, reduced to a single cut of 35 feet width 16.07 miles. Total number cubic yards of material removed in accordance with the terms of the contract, 721,730.

By act of Congress August 2, 1882, an additional sum of $125,000 was appropriated for the continuation of the improvement, and bids were opened September 30. The contract was awarded to Mr. R. Moore, of Mobile, Ala., his bid, 12½ cents per cubic yard, being the lowest (see abstract of bids, hereunto annexed), and date of commencement fixed upon February 15, 1883. The contractor commenced operations January 24, 1883, working night and day.

The progress of the improvement during the fiscal year ending June 30, 1883, is as follows:

	Width, feet.	Length, miles.
Cut No. 1	40	8.07
Cut No. 2	35	7.75
Cut No. 3	35	8.18
Cut No. 4	35	0.89
Cut No. 5	35	0.19
Cut No. 6	35	0.19
Cut No. 7	35	0.20
Total		25.47

WORK OF GEORGE C. FOBES & CO.

	Width, feet.	Length, miles.
Cut No. 1	40	4.42
Cut No. 2	35	6.22
Cut No. 3	35	0.34
Cut No. 4	35	0.19
Cut No. 5	35	0.19
Cut No. 6	35	0.19
Cut No. 7	35	0.09
Total		11.64

Distance refilled and redredged, 36 miles.
Total distance dredged, 12 miles.
Total amount material excavated under this contract, 457,366 cubic yards.

WORK OF G. L. LONG.

	Width, feet.	Length, miles.
Cut No. 1	40	3.65
Cut No. 2	35	1.53
Cut No. 3	35	3.34
Cut No. 4	35	0.70
Cut No. 7	35	0.11
Experimental cut 22 feet depth		0.17
Total		9.50
Number of cubic yards of material excavated under this contract		419,901
Removal of two wrecks, equivalent to		9,514
Total	cubic yards	429,415

WORK OF R. MOORE.

Cut No. 3: Width, 35 feet; length, 4.50 miles. Number cubic yards of material excavated under this contract up to June 30, 1883, 251,666.

ENTIRE DISTANCE OF SINGLE CUT DREDGED DURING YEAR 1882–1883.

	Miles.
Geo. C. Fobes & Co	12.00
G. L. Long	9.50
R. Moore	4.50
Total	26.00

NUMBER OF CUBIC YARDS OF MATERIAL EXCAVATED UNDER THE VARIOUS CONTRACTS DURING THE FISCAL YEAR ENDING JUNE 30, 1883.

	Cubic yards.
Geo. C. Fobes & Co	457,366
G. L. Long	419,901
G. L. Long, extra	9,514
R. Moore	251,666
Total	1,138,447

That portion of Cut No. 1 at the mouth of Mobile River, mentioned in annual report of 1881 and 1882 as having refilled, was redredged by Geo. C. Fobes & Co., and the channel through "Choctaw Pass" at this point was opened to 145 feet width, since when no refilling or shoaling has been perceptible.

The wrecks, also mentioned in same report, have been removed by G. L. Long, by the clam dredge T. H. Herndon, tearing them apart and then removing the *débris*.

The condition of the improvement June 30, 1883, was as follows: Commencing at the northern entrance of the projected 17-foot channel in Mobile River, Cuts Nos. 1, 2, 3, and 4 have been taken out to the upper gap of the "obstructions," a distance of 3,820 feet, and giving a width of 145 feet, with a minimum depth of 18 feet at mean winter tide. From the upper gap to Cluster No. 2, a distance of 1,000 feet, Cuts Nos. 1, 2, 3, 4, 5, 6, and 7 have been removed, giving a width tothe sharp bend at this point equal to 240 feet. From Cluster No. 2 to Pile No. 19 (3d south of Cut No. 6), below the bend on Dog River Bar, a distance of 17,083 feet, Cuts Nos. 1, 2, and 3 have been removed, making a total length of channel to this point from the northern entrance, with a minimum width of 105 feet, =21,903 feet=4.15 miles. From Pile No. 19 to Pile No. 102 (2d south of Cut No. 27 on Fowl River Shoals), a distance of 56,083 feet, =10.62 miles, Cuts 1 and 2 have been dredged, giving a channel of minimum width of 75 feet, with minimum depth at mean low tide=17 feet. From Pile No. 102 to Pile No. 133, a distance of 21,287 feet =4.03 miles, Cuts 1, 2, and 3 have been dredged with minimum width of 105 feet and depth of 17 feet. From Pile No. 133 to Cluster No. 50, a distance of 39,724 feet =7.53 miles, the channel is only 75 feet wide.

This portion was originally dug to 17 feet at mean low tide, but, owing to the extreme softness of the material composing the bottom, the natural slope is great, being equal to about 1 to 12, so, with a bank of 5 feet, the foot of slope extends on each side at least 60 feet; consequently the channel has apparently refilled to a depth of 16 feet, but as the width is increased to the westward, this tendency to refilling will probably cease, and when the 200 feet width is attained it is expected the depth of 17 feet will be permanent in the center of the cut.

The distance remaining to be dredged, in order to give a channel 105 feet width from Mobile to the lower anchorage, is as follows:

From Pile No. 19 to Pile No. 102, between Dog River and Fowl River shoals, 56,083 feet =10.62 miles, and from No. 133 to Cluster No. 50, a distance of 39,724 feet = 7.53 miles, a total length of 18.15 miles.

The experimental cut of 22 feet depth recommended to be dredged by the Board of Engineers in their report of 1880, in order to determine whether a channel of that depth would remain open, was dredged September, 1882, by G. L. Long, contractor, and is located in the bend below the lights on Dog River Bar, commencing at Cluster No. 5, at the north end of the bend, and extending south 300 feet, with a width of 100 feet.

It was sounded October 24, 1882, and again on June 7, 1883, an in-

terval of about seven months. A comparison of these soundings showed less depth on the sides and ends of the cut, with about the same average depth along the center, evidently owing to the irregularities of the bottom being removed and the banks having assumed the natural slope, but showed no filling due to other causes.

As the material composing the bottom is the same or of a firmer nature to Cluster No. 31, just south of Fowl River Shoals, 16.44 miles from the city, a channel of this depth would no doubt remain open, and it is probable that from this point it would be comparatively permanent with a width of 400 feet.

Work of each dredge compared.

	Dredge Mobile, Geo. C. Fobes & Co.	Dredge Col. Chaighill, George C. Fobes & Co.	Dredge Alabama, Geo. C. Fobes & Co.
Date of commencement	Feb. 19, 1881	Sept. 22, 1881	May 20, 1882
Date of completion	Sept. 9, 1882	Aug. 31, 1882	Nov. 21, 1882
Total cubic yards removed	668, 447	759, 473	231, 531
Total cubic yards deducted	34, 371	4, 983	9, 213
Total cubic yards paid for	634, 076	754, 490	222, 318
Total cubic yards distance feet	92, 282	99, 361	29, 554
Number of days worked (twelve hours)	387	110	43
Number of days worked (twenty-four hours)	.....	157¾	69
Number of days lost (weather)	15½	15¾	5
Number of days lost (other causes)	79	41½	28
Average daily distance twelve hours ..... feet	238. 4	221	163. 6
Average daily distance twenty-four hours ..... do	.....	412. 3	326. 3
Average daily material, cubic yards, twelve hours	1, 727. 3	1, 968. 3	1, 322
Average daily material, cubic yards, twenty-four hours	.....	3, 441. 3	2, 531. 6

	Dredge T. H. Herndon, G. L. Long.	Dredge T. H. Herndon, R. Moore.	Dredge Senator Pugh, R. Moore.
Date of commencement	Mar. 21, 1882	Jan. 24, 1883	Apr. 30, 1883
Date of completion	Jan. 24, 1883	Mar. 4, 1883	.....
Total cubic yards removed	737, 170	117, 676	141, 075
Tatal cubic yards deducted	12, 440	2, 000	5, 085
Total cubic yards paid for	724, 730	115, 676	135, 990
Total cubic yards distance feet	85, 320	12, 614	10, 820
Number of days worked (twelve hours)	20½	.....	23
Number of days worked (twenty-four hours)	196¾	36½	29¼
Number of days lost (weather)	19½	1½	.....
Number of days lost (other causes)	27½	3	¼
Average daily distance, twelve hours ..... feet	314¼	.....	110
Average daily distance, twenty-four hours ..... do	400. 4	346	281
Average daily material, cubic yards, twelve hours	2, 594. 6	.....	1, 712
Average daily material, cubic yards, twenty-four hours	3, 476. 4	3, 223. 8	3, 352

SUMMARY OF WORK TO JUNE 30, 1883.

George C. Forbes & Company:

			Miles.
Cut Number 1.	1880–'81, 1881–'82, 1882–'83	Width, 40 feet; length 4.07 miles, 14.19 miles, 4.42 miles	22.68
Cut Number 2.	1881–'82, 1882–'83	Width, 35 feet; length 12.01 miles, 6.22 miles	18.21
Cut Number 3. 1882–'83.		Width, 35 feet; length	.34
Cuts Numbers 4, 5, and 6, 1882–'83.		Width, 35 feet; length each, 0.19 miles	.57
Cut Number 7. 1882–'83.		Width, 35 feet; length	.09
			41.89
Cut Number 1. 1882–'83.		Redredged where refilled	.36
		Total	42.25

G. L. Long, esq.:

	Miles.
Cut Number 1. 1882–'83. Width, 40 feet; length	3.65
Cut Number 2. 1881–'82, 1882–'83. Width, 35 feet; length 6.57 miles, 1.53 miles	8.12
Cut Number 3. 1882–'83. Width, 35 feet; length	3.34
Cut Number 4. 1882–'83. Width, 35 feet; length	.70
Cut Number 7. 1882–'83. Width, 35 feet; length	.11
	15.92
Experimental cut, 1882–'83. Length	.17
Total	16.09

R oie, esq.:

Cut Number 3. 1882–'83. Width, 35 feet; length	4.50
Total distance of single cut	62.84

George C. Fobes & Co.:

	Cubic yards.	
1880–'81	143,149	
1881–'82	1,010,289	
1882–'83	457,366	
		1,610,804

G. L. Long, esq.:

1881–'82	295,315	
1882–'83	419,901	
Wrecks	9,514	
		724,730

R. Moore:

1882–'83	251,666
Total number cubic yards to June 30, 1883	2,587,200

LENGTH OF EACH CUT DREDGED TO DATE.

	Miles.
Cut Number 1. Width, 40 feet; length	26.33
Cut Number 2. Width, 35 feet; length	26.33
Cut Number 3. Width, 35 feet; length	8.18
Cut Number 4. Width, 35 feet; length	.89
Cuts Numbers 5, 6, and 7. Width, 35 feet; length 0.19, .19, .20	.58
Experimental cut	.17
Redredging portion Cut Number 1 (refilled)	.36
Total length	62.84

Before the improvement, which was commenced February, 1881, all vessels of greater draught than 13 feet were compelled to anchor in the lower portion of the bay, 28½ miles from Mobile, and their cargoes, in and out, were lightered to and from the port, thus entailing great cost and loss of time. Since the channel has been opened (even to the width of 75 feet) to the "lower fleet," all vessels drawing from 16 feet to 18 feet have proceeded to the wharves, then loaded with full cargo or from 16 feet to 18 feet, and passed through the channel without delay beyond that due to low tides on account of continuous north winds or its narrowness. The channel was opened to this width October, 1882, and has been available since that date to vessels of less draught than 17 feet,

but is still too narrow for them to pass each other, and is, therefore, a drawback to the rapid increase of the commerce of the port on that account. In this connection it is proper to state that during the past spring the outer bar was carefully sounded, and at mean low tide of 17 feet there was found to be 23 feet of water, which shows that the gradual increase of depth referred to in annual report 1882 still continues, but shifting to the westward of the former location of the channel.

It is proposed to apply the fund available for expenditure during the fiscal year ending June 30, 1884, to completing Cut No. 3, now being dredged, and thus give a channel with average width of 110 feet, and a minimum of 105 feet, and it is expected that this will be accomplished by January, 1884, when the funds now available will probably be exhausted.

The sum of $420,000 can be profitably expended during the fiscal year ending June 30, 1884, and it is proposed to use said appropriation, in the event it is made, toward carrying to completion the channel as projected March, 1880.

The estimated cost of the improvement as originally projected was $820,000; this amount will be somewhat increased by the additional depth of 1 foot, and additional width of channel at the bends in Choctaw Pass and through the obstructions (See Alterations 3 and 1).

The appropriations made by Congress to date since 1879 for the present project, amounted to $450,000 (given in detail in former portion of this report), and the amount required for completion as now contemplated is $420,000.

From the initial point in Mobile River to the upper gap of the obstructions, length 3,820 feet, width is now 145 feet, leaving 155 feet to be dredged, and about 142,759 cubic yards to be removed to give a width of 300 feet, and about 200 feet of the upper line of obstructions to be taken out thence to Cluster No. 2, distance of 1,000 feet, which is now 240 feet wide; 160 feet remains to be dredged to give 400 feet width in this bend, and about 33,894 cubic yards to be removed; from Cluster No. 2 to the lower gap of the obstructions, a distance of 4,616 feet, now 105 feet minimum width, 145 feet remains to be dredged to give contemplated width of 250 feet and about 114,293 cubic yards to be removed; from upper gap of the obstructions to Pile No. 19, 12,467 feet, the channel is 105 feet minimum width, and 95 feet is to be dredged to give 200 feet width, with about 328,726 cubic yards to be removed; from Pile No. 19 to Pile No. 102 on Fowl River Shoals a distance of 56,083 feet, it is 75 feet wide, 125 feet to be dredged and about 1,813,650 cubic yards to be removed; from Pile No. 102 to Pile No. 133 a distance of 21,287 feet, the width is now 105 feet minimum, 95 feet to be dredged and 515,120 cubic yards to be removed; and finally from Pile No. 133 to Cluster No. 50, 39,724 feet, the channel is to be increased from its present minimum width of 75 feet to 200 feet, and about 1,126,921 cubic yards to be removed.

The total number of cubic yards (approximate) of material to be removed, 4,131,108.

Approximate estimated cost at present prices, $503,995.

The refilling of the channel at the mouth of the Mobile River, referred to in report of 1881 and 1882, has been removed, and as yet shows no tendency to refill.

The general character of the channel already dredged would seem to indicate that the improvement, when completed, will be comparatively permanent; that it will not require an annual, and, possibly, not a

periodical appropriation of any great amount, in order to maintain the requisite 17 foot depth. The portion as yet uncertain is that south of Fowl River Shoals.

The improvement is located in the collection district of Mobile. Mobile is the nearest port of entry, and is at the head of bay of the same name.

The channel of 17 feet depth has not been opened a long enough period of time, neither is it yet sufficiently wide to make an approximate estimate as to what may be the probable effect the completion of the present project will have upon the commerce of Mobile. By a comparison of the amount of shipping that came to this harbor during each of the fiscal years 1880, 1882, 1883, it will be seen, however, that there has already been a steady increase, and the prospects for a much larger increase during the ensuing fiscal year are very flattering.

As confidence in an early completion of the channel as projected and also in its comparative permanency has become greater the business and commerce has assumed a healthy condition, realty has increased in value, new industries are springing up, new companies forming to make Mobile the principal shipping point for the vast coal and lumber interests now being so rapidly developed in the State of Alabama, of which this is the only port of entry.

Money statement.

July 1, 1882, amount available		$115,276 28
Amount appropriated by act passed August 2, 1882		125,000 00
		240,276 28
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$147,469 47	
July 1, 1883, outstanding liabilities	3,070 29	
		150,539 76
July 1, 1883, amount available		89,736 52
Amount (estimated) required for completion of existing project		420,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		420,000 00

Abstract of bids received and opened September 30, 1882, dredging at Mobile Harbor, Alabama.

No.	Names and addresses of bidders.	Price.	Date of commencement.	Date of completion.
		Pr. cu. yd.		
1	George C. Fobes & Co	$0 12 6/10	In accordance with the specifications.	In accordance with the specifications.
2	S. N. Kimball	15	ditto	Do.
3	John Maguire	13 1/3	ditto	Do.
4	Rittenhouse Moore	12 2/10	ditto	Do.
5	James E. Slaughter	10 3/4	ditto	Do.

James E. Slaughter was allowed to withdraw his bid.

COMMERCIAL STATISTICS.

The following statistical statement of the commerce of Mobile for the fiscal years 1881 and 1883 was furnished by the collector of customs at this port:

Entries and clearances at the port of Mobile.

ENTRIES.

	June 30, 1883.			June 30, 1881.		
	Vessels.	Tonnage.	Crew.	Vessels.	Tonnage.	Crew.
Foreign	105	60, 602	1, 324	99	69, 019	1, 492
Coastwise	51	18, 379	424	57	20, 606	376
American	42	7, 885	308	40	14, 982	454
Total	198	86, 866	2, 056	196	104, 607	2, 322

CLEARANCES.

Foreign	112	66, 998	1, 323	72	64, 679	1, 384
Coastwise	50	18, 551	411	54	18, 690	497
American	54	11, 492	382	46	17, 777	400
Total	216	97, 041	2, 116	172	101, 146	2, 281

Commercial statistics.

	June, 1883.	June, 1881.
Duties on imports	$200, 742 12	$226, 116 59
Tonnage dues	12, 833 50	16, 854 00
Hospital collections	3, 750 32	2, 803 77
Miscellaneous	4, 811 28	12, 407 74
Total collections	222, 137 22	258, 182 10
Exports to foreign ports	2, 837, 496 00	6, 594, 840 00
Imports of foreign goods	390, 535 00	659, 397 00

Number and character of vessels entering and clearing at the port of Mobile.

1881 AND 1882.

Vessels.	No.	Tonnage.	Foreign cargoes.		Coastwise cargoes.		Foreign in ballast.		Coastwise in ballast.	
			In.	Out.	In.	Out.	In.	Out.	In.	Out.
Steamers	3	1, 514	1	3	.....	.....	1	.....	1	.....
Ships	13	14, 802	1	12	1	.....	10	.....	1	1
Barks	87	55, 274	4	63	5	6	64	.....	4	9
Brigs	23	6, 127	4	14	7	13	3	.....	9	.....
Schooners	117	23, 002	24	50	17	53	9	1	67	5
Total	243	102, 719	34	138	30	72	87	1	82	15

1882 AND 1883.

Steamers	8	3, 802	.....	1	7	6	1	.....	1	2
Ships	15	15, 650	3	11	.....	2	11	.....	1	1
Barks	103	59, 600	11	83	2	9	68	.....	12	1
Brigs	18	5, 530	2	14	5	1	8	.....	3	3
Schooners	154	27, 803	20	53	42	75	26	3	63	14
Total	298	112, 385	36	162	56	93	114	3	80	21

The following is a statement of the number and character of vessels of greater draught than 13 feet that have passed through the 17-foot channel without any material delay during the fiscal year ending June 30, 1883:

1882–1883.	Steamers.		Ships.		Barks.		Brigs.		Schooners.		Total.	
Draught.	Up.	Down.	Up.	Down.	Up.	Down.	Up.	Down.	Up.	Down.	Up.	Down.
13 to 14 feet	1	1	5	4	14	20	2	7	6	25	28	57
14 to 15 feet	.....	.....	6	.....	4	8	1	1	1	13	12	22
15 to 16 feet	.....	.....	2	2	4	7	.....	1	.....	6	6	16
16 to 17 feet	.....	1	1	5	4	35	.....	1	.....	2	5	44
17 to 17½ feet	.....	.....	.....	3	.....	14	.....	.....	.....	.....	.....	17
17½ to 18 feet	.....	.....	.....	.....	.....	3	.....	.....	.....	.....	.....	3
Total	1	2	14	14	26	87	3	10	7	46	51	159

1881–'82.	
13-foot draught vessels up and down	48
13½-foot draught vessels up and down	19
14-foot draught vessels up and down	3
14½-foot draught vessels up and down	1
Total	71

1879–'80.	
13-foot draught vessels up and down	25
13½-foot draught vessels up and down	4
Total	29

Number and character of craft engaged in the traffic of Mobile Harbor.

Vessels.	1883.		1882.	
	No.	Tonnage.	No.	Tonnage.
Steamers (passenger)	5	1,198	4	877
Sloops	21	121.6	17	75
Schooners	59	1,139	24	843
Tugs	20	1,317	12	1,181
Barges	21	1,375	31	2,394
Fishing smacks	10	314	6	170

Mobile Cotton Exchange statistics.

Cotton receipts.	1883.	1882.	1881.
Via Alabama River, bales	40,192	39,692	46,434
Via Tombigbee River, do	52,600	45,494	66,966
Via Warrior River, do	12,647	964	15,638
Via Mobile and Ohio Railroad, do	132,039	123,568	159,575
Via Mobile and Montgomery Railroad, do	75,100	59,469	98,231
Via coastwise, do	1,583	2,073	540
Total	314,161	271,260	387,384
Coffee importations, sacks	23,480	23,332	18,848
Naval stores:			
Resin	187,345	160,971	154,837
Turpentine	38,332	25,314	22,549
Tar	500	440	400
Pitch	3,000	2,750	2,500
Salt:			
Imported from Liverpool direct, sacks	18,160	28,398	77,627
Imported from Liverpool indirect, do	6,666	8,588	7,000
Imported coastwise, Vermillion Bay, do	114,765	75,557	1,800
Imported from other points, do	.....	.....	2,000
Total	139,591	112,543	104,638

Commercial statistics.

Articles.	1883.	1882.	1881.
Fish and oysters ..... value..	$157,500	$157,500	$150,000
Vegetables ..... do...	332,541	437,267	174,483
Wool ..... do...	375,000	450,000	325,786
Alabama coal ..... tons..	26,564	19,062	8,189
Pennsylvania and English coal ..... do ..	1,229	1,108	2,701
Bagging ..... rolls..	29,013	13,770	9,257
Cotton ties ..... bundles..	58,716	41,154	42,315
Bacon ..... casks..	9,242	9,216	8,829
Flour ..... barrels..	93,925	80,428	90,013
Molasses ..... do...	4,357	5,988	5,773
Sugar ..... hogsheads..	3,338	4,277	4,035
Whisky ..... barrels..	6,421	6,613	7,954
Pork ..... do...	4,243	1,888	1,874
Fertilizers ..... sacks..	81,305	59,530	57,062
Corn ..... do...	214,451	255,709	345,307
Bran ..... do...	50,554	42,945	43,996
Hay ..... bales..	32,006	22,339	27,490
Tobacco ..... boxes..	18,627	17,968	17,404

Comparative statement of lumber and timber shipments to foreign and coastwise ports.

Description.	1883.	1882.	1881.
Lumber:			
Foreign ..... feet B. M..	16,629,928	27,805,777	11,531,246
Coastwise ..... do....	9,319,039	6,951,444	9,587,562
Interior (estimated) ..... do ..	7,900,000	5,000,000	4,500,000
Total	33,848,967	39,757,221	25,618,808
Timber:			
Foreign ..... feet B. M..	18,373,104	17,097,160	20,326,056
Coastwise ..... do....	53,940	4,274,290	131,832
Interior ..... do....	.....	.....	.....
Total	18,427,044	21,371,450	20,457,888
Shingles:			
Foreign ..... number..	1,904,250	1,848,450	3,900,000
Coastwise ..... do....	2,129,052	1,789,300	2,160,000
Interior (estimated) ..... do....	11,000,000	10,832,000	.....
Total	15,033,302	14,469,750	6,060,250
Staves:			
Foreign ..... number..	101,886	97,926	91,462
Coastwise ..... do....	.....	4,800	.....
Interior (estimated) ..... do....	5,000	7,200	.....
Total	106,886	109,926	91,462
Laths:			
Foreign ..... number..	.....	.....	.....
Coastwise ..... do....	.....	.....	256,000
Interior (estimated) ..... do....	5,500,000	.....	.....
Total	5,500,000	.....	256,000

M 2.

IMPROVEMENT OF PENSACOLA HARBOR, FLORIDA.

The improvement of this harbor was commenced November, 1878, by the removal of four wrecks near its entrance forming obstructions to navigation.

A survey of the harbor was made during the second quarter of 1879, for the purpose of ascertaining the extent and probable cause of the shoaling of the main ship-channel at the point known as the "inner bar" or "twenty-one foot lump."

A report embracing the results of the survey was referred to the Board of Engineers, and a project for the improvement of the harbor

adopted, consisting of dredging a channel across the newly formed bar, and the construction of jetties along the western shore-line for the purpose of arresting the abrasion, preserving the shore-line for defensive works, and restoring, as far as possible, the former regimen of tidal currents, with its effect in keeping the channel open.

A contract was made July 28, 1881, for dredging the channel in accordance with the new project, but no work was performed by the contractor, and his contract was annulled.

The work was readvertised May 26, 1882, bids opened June 26, and the contract awarded; but no work was performed by the contractor, and his contract was annulled. The work was readvertised October 30, 1882, and the bids opened December 1, 1882. Mr. Seth N. Kimball being the lowest bidder, at 79.7 cents per cubic yard, was awarded the contract.

The construction of the first series of proposed jetties had also been submitted for proposals, but the bids for executing the work were considered excessive, and instructions were given to carry it on by hired labor and purchase of material in open market, and the construction of buildings and appliances necessary to prosecute the work was begun in October, 1881.

The progress made during the fiscal year ending June 30, 1883, has been as follows:

The work of dredging the "inner bar" was commenced under contract with Seth N. Kimball, on the 30th of April, 1883. The number of cubic yards of material removed is 8,406, and the estimated quantity of material remaining to be removed to complete the cut to the proposed width of 300 feet is 60,000 cubic yards.

The progress made in the other branch of the work has been the completion of Jetty A, with crest protected with close piling 4½ feet above mean low water, 120 feet from original shore-line, and mattress work sloping from extremity of close piling to a point 410 feet from shore-line; the partial completion of shore protection north of "Jetty A," with crest protected with close piling 4½ feet above mean low water, and extending 200 feet from original shore-line; the completion of pier with wharf at outer extremity, 400 feet from shore-line, and completion of office and quarters for assistant engineer. The progress of this branch of the work has been somewhat impeded by the occurrence of yellow fever at Pensacola during the summer and fall of 1882, preventing the conclusion of any arrangement for the supply of rock ballast required for the construction of the jetties until after the removal of the quarantine. In the mean time the only available material for ballast was the *débris* of Fort McRee, consisting of loose brick. The lightness of this material required that its use should be confined chiefly to that part of work sufficiently below the oscillation of storm waves to escape their force. By careful manipulation, however, attended with occasional auspicious conditions of winds and currents, the satisfactory result was obtained of gradually advancing the shore-line and shoaling the water in front of the beach line from a point half a mile north of the work to the water battery on the south of it. An arrangement was concluded February 5, 1883, with E. F. Skinner, for the hire of two barges and towage for the transportation of ballast to the works. The rock ballast contained in crib at old quarantine ground was purchased from the owners, Messrs. Hyer Brothers, and 1,410 tons were transported to Fort McRee during the months of February and March, at a cost of $1.32 per ton. There were also delivered at Fort McRee, by Dennis Burns, 392 tons, at $1.50 per ton, and on barge at Pensacola 34 tons, at $1.10 per ton.

The condition of the improvement referable to the work accomplished

on the jetty and shore protection is an advance of the shore-line at Fort McRee about 120 feet, with a corresponding advance of the slope to the 24-foot curve. A marked change has also taken place in the contour of the bottom, north of the works, extending in the direction of the light-house. For several hundred feet in front of the beach the water has shoaled generally from a depth of 7 to 9 feet to 1 and 4 feet.

In regard to the dredging of the "inner bar," the work has not yet advanced sufficiently to add to the facility of navigation. Upon the completion of the work under the present contract it is thought that a channel-way will be afforded of 24 feet depth at mean high tide and 150 feet in width.

It is proposed that the funds available for expenditure during the fiscal year ending June 30, 1884, be applied to a continuation of such work upon the jetty and shore protections now in progress, as the results accomplished by them may indicate to be advisable, and the commencement of such other works embraced in this branch of the project as may be expedient, the construction of "Jetty B," and one or more shore protections between it and "Jetty A."

The result so far accomplished indicates that the shore protections now in progress of construction north of "Jetty A" will be the only work required upon that side. Its extension and that of the crest of "Jetty A" with close piling will doubtless be found necessary, but should be extended relatively to the advance of the slope.

It is proposed also that the work of dredging be continued with a view of obtaining an increased width and depth of channel across the bar.

The results that may be expected from the former will be an advance and preservation of the western shore-line and channel curves, as contemplated in the project, and from the latter a more spacious channel for navigation across the "inner bar."

The sum of $55,000 can be profitably expended during the fiscal year ending June 30, 1885, in augmenting width of channel-way across the "inner bar," affording additional safety and facility to navigation, and in constructing the proposed works for restoring and preserving the west shore-lines.

The estimated amount, exclusive of appropriations already made for the entire completion of the existing project, is $55,000.

An annual expenditure will be required for repairing jetties and shore projections and removal of accumulation in the channel, but the amount cannot be accurately estimated at present. "It is not an easy problem to stay the wearing away of a beach where there is a constant tendency to encroachment. It will require watching, and doubtless frequent appropriations to meet unforeseen contingencies."

The work is situated in the collection district of Pensacola, Fla., which is the port of entry, and near Pensacola light-house and Forts Pickens and Barrancas.

Money statement.

July 1, 1882, amount available		$51,859 34
Amount appropriated by act passed August 2, 1882		50,000 00
		101,859 34
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities, July 1, 1882	$34,884 87	
July 1, 1883, outstanding liabilities	669 75	
		35,554 62
July 1, 1883, amount available		66,304 72
Amount (estimated) required for completion of existing project		55,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		55,000 00

Abstract of bids received and opened September 30, 1882, *dredging in Pensacola Harbor Florida.*

No.	Names of bidders.	Price per cubic yard.	Date of commencing.	Date of completion.
		Per cu. yd.		
1	Geo. C. Fobes & Co.....	$0 95	In accordance with specifications.	In accordance with specifications.
2	S. N. Kimball.....	0 79 7/10	.....do	Do.
3	P. F. Nouvet.....	0 83½	.....do	Do.

COMMERCIAL STATISTICS.

Exports port of Pensacola, Fla., during the fiscal year ending June 30, 1883.

Destination.	Vessels.	Tonnage.	Hewn timber.	Sawn timber.	Lumber.	Cotton.
			Cubic feet.	*Cubic feet.*	*Sup. ft.*	*Bales.*
Great Britain.....	188	144, 333	1, 903, 280	5, 304, 910	11, 177, 000	.....
Continent of Europe.....	99	57, 131	809, 827	1, 300, 409	13, 780, 000	100
Australia and Africa.....	3	1, 769	34, 578	3, 797	737, 000	.....
West Indies, South America.....	132	52, 793	56, 268	33, 668	36, 599, 000	.....
Coastwise.....	123	50, 239	.....	.....	37, 772, 000	2, 300
Total.....	545	306, 265	2, 803, 953	6, 642, 784	100, 065, 000	2, 400

Custom-house statistics, Pensacola, Fla., for fiscal year ending June 30, 1883.

ENTRANCES.

	No.	Tons.
American vessels entered from foreign ports.....	60	24, 031
Foreign vessels entered from foreign ports.....	334	216, 759
Coastwise.....	152	60, 713
Total.....	546	301, 503

CLEARANCES.

American vessels cleared to foreign ports.....	73	28, 313
Foreign vessels cleared to foreign ports.....	351	227, 297
Coastwise.....	141	53, 805
Total.....	565	309, 415

Value of imports.....	$29, 139
Value of exports.....	2, 068, 057
Total value exports and imports.....	2, 097, 196

CUSTOM-HOUSE RECEIPTS.

Duties on imports.....	$7, 678 25
Tonnage tax.....	43, 106 83
Marine-hospital tax.....	2, 212 46
Fines, penalties, and forfeitures.....	775 50
Inspection of steam vessels.....	402 70
Immigrant fund.....	6 00
Official fees.....	3, 718 85
Total.....	57, 900 59

M 3.

IMPROVEMENT OF KEY WEST HARBOR, FLORIDA.

The examination of this harbor under provisions of third section of the river and harbor act, March 3, 1881, was completed in January, 1882. The report was submitted in February, 1882, and is contained in Annual Report of Chief of Engineers, 1882, Appendix K 25.

The improvement desired is the deepening of the "Northwest Channel" from its present depth of 11 feet, which is insufficient for commercial purposes, to 17 feet. The work to consist of dredging, at an estimated cost of about $140,000.

An appropriation of $25,000 was made by act of Congress passed August 2, 1882, but the officer in charge was restricted in the application of the funds to March 1, 1883.

Advertisements for proposals for dredging were published August 30, 1882, and bids opened September 30, 1882. Abstract of bids, forwarded on date of opening, showed Mr. S. N. Kimball, of Mobile, Ala., to be the lowest bidder, at $1.30 per cubic yard; the contract was not, however, awarded until March 9, 1883. Articles of agreement and bonds were forwarded and returned approved during the month of May.

As the time specified for the commencement of this work is not until July 16, 1883, no work was inaugurated during this fiscal year.

The benefit to be derived by the completion of this improvement is the great saving in time for all vessels plying between Key West and the Gulf ports; an estimated distance of 100 miles will be saved by the dredging of this channel. All vessels drawing over 10 feet are now compelled to make the circuitous route around Dry Tortugas.

The sum of $115,000 can be profitably expended during the fiscal year ending June 30, 1885, to be used in dredging, in accordance with plan adopted.

The improvement, when completed, it is thought will not be permanent.

Key West Harbor is in the collection district of Key West, and Key West is the nearest port of entry.

Money statement.

Amount appropriated by act passed August 2, 1882	$25,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	1,426 88
July 1, 1883, amount available	23,573 12
Amount (estimated) required for completion of existing project	115,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	115,000 00

Abstract of bids received and opened September 30, 1882, dredging at Key West Harbor, Florida.

No.	Names of bidders.	Price.	Date of commencement.	Date of completion.
		Pr. cu. yd.		
1	Geo. C. Fobes & Co	$1 80	In accordance with specifications.	In accordance with specifications.
2	S. N. Kimball	1 30	....do	Do.
3	John Maguire	1 33⅓	....do	Do.
4	Rittenhouse Moore	1 60	....do	Do.

M 4.

IMPROVEMENT OF CHATTAHOOCHEE RIVER, GEORGIA AND ALABAMA.

The work of improvement was commenced in the summer of 1874. The channel was badly obstructed with snags, sand-bars, and marl reefs, affording a low-water depth of from 1 to 4 feet, and a width of from 35 to 500 feet. Between the shoals were deep pools needing no improvement, but the general availability for purposes of commerce was bad. The original project of improvement contemplated a low-water channel of 4 feet depth and 100 feet width, to be secured by removing snags and overhanging timber, blasting out the rock shoals, and deepening the sand-bars by scour, by the use of brush jetties, so constructed as to control the low-water flow solely.

No amendments or alterations have been since made.

The following tabulated statement shows the progress made during the fiscal year ending June 30, 1883:

Snags and overhanging trees removed	292
Linear feet of jetty built	2,060
Linear feet of rock drilled	404
Number of blasts made	115
Number pounds powder used	319
Number of pounds of dynamite used	56½
Number of cubic yards of rock removed	1,968

Condition of improvement November 30, 1882.

No.	Names of places.	Below Columbus, Ga.	Above Chattahoochie, Fla.	Original depth.	Present depth.	Original width.	Present width.	Remarks.
		Miles.	*Miles.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	
1	South Commons	1	223	2	4	300	160	Brush jetties.
2	Mound Bar	7	217	2½	4	350	150	Do.
3	Abercrombie's Bar	8	216	1	4	350	150	Do.
4	Woolfolk's Bar	10	214	1½	4	500	150	Do.
5	Upatoie Bar	11	213	2	4	300	150	Do.
6	Little Uchee Shoal	17	207	2	4	50	60	Being completed.
7	Reef below shoal	17½	206½	1½	4	50	60	Blasted.
8	Sleek Bluff Shoal	18	206	0	4	39	55	Do.
9	Middle Rocks Shoal	18½	205½	1½	4	30	100	Do.
10	Big Uchee Shoal	19	205	1½	4	35	65	Do.
11	Betton's Upper Rock	20½	203½	0	4	40	180	Do.
12	Betton's Lower Rock	21	203	0	4	50	200	Do.
13	Cody's Rock	22	202	1	4	40	100	Do.
14	Shell Creek Bar	24	200	3	3	350	350	Shore protection.
15	Culpeper Island	32	192	2	4	400	100	Jetties and blasting.
16	Hardridge's Shoal	112	112	2	4	35	100	Blasted.

During this fiscal year the improvement was completed by blasting and removal of rocks at Cody's Rock, Betton's Upper Rock, and Betton's Lower Rock.

The channel at Little Uchee Shoals was widened from 60 feet to 80 feet in the same manner. Repairs and extensions were made to the works previously constructed at Mound Bar, and the portion of the river near Columbus, and between it and Bull Creek, was improved by contracting its original width of 300 feet to 160 feet by brush jetties. This latter improvement, though not completed, resulted in deepening the

channel from 2 to 4 feet nearly all the way through, and there has been no detention to boats this year.

It is proposed during the next fiscal year to clear the entire length of the river of snags and overhanging trees, to widen the channel by blasting at Little Uchee and Sleek Bluff, repair works already constructed wherever needed, and complete the improvement between Columbus and Bull Creek by use of jetties.

If sufficient funds are available, the next work to be undertaken will be the improvement of Frances Bar, 6 miles above Eufaula, Ala., and King's Rock, 16 miles above the mouth of the river.

This improvement will not be permanent. It is estimated that it will require about $10,000 annually to preserve the river in the improved condition contemplated by the project.

The cost of the work will exceed the original estimate, but not probably more than the cost of work not included in it which has been and has to be done; that is, the annual removal of snags and overhanging trees, and repairs of works already constructed since the beginning of the improvement.

Money statement.

July 1, 1882, amount available	$16,789 90
Amount appropriated by act passed August 2, 1882	25,000 00
	41,789 90
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	15,372 54
July 1, 1883, amount available	26,417 36
Amount (estimated) required for completion of existing project	150,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	100,000 00

COMMERCIAL STATISTICS.

The following table shows the capacity, size, &c., of the steamboats now on the Chattahoochee River:

Description.	Throonateska.	Rebecca Everingham.	Clara Dunning.	Remarks.
Length ..... feet..	130	131	152	Since the last report the following changes have taken place:
Breadth ..... do...	35	26	41	
Depth of hold ..... do...	3½	4	4	Steamer Caddo Belle transferred to the Suwannee River.
Number of cylinders	2	2	2	
Cylinders ..... inches..	10	10	10	Steamer Chattahoochee transferred to the Saint John's River.
Stroke ..... feet..	4½	4½	4½	
Number of boilers	2	1	2	Steamer Geo. W. Wylly has been sunk.
Boilers ..... feet..	20	22	22	
Diameters of boilers	38	40	40	
Draught aft ..... feet..	20	24	26	
Draught forward ..... do...	14	16	21	
Capacity ..... bales..	750	800	1,000	

The steamer Amos Hays is now being built, and will be running by August 1.

The steamers ply the river the year through, and during the past year there has been no interruption to commerce on account of low water, sand bars, snags, &c.

The receipts of cotton at Columbus, Ga., from points on the river are 5,566 bales in excess of 1882.

The following table shows the business done by the steamboats on the Chattahoochee River for the year ending June 30, 1883:

Fertilizers:		
Quantity	tons..	5,400
Value		$243,000
Iron:		
Quantity	tons..	273
Value		$20,748
Cotton:		
Quantity	bales..	47,212
Value		$2,064,540
Grain:		
Quantity	bushels..	125,986
Value		$100,784
Lumber:		
Quantity	feet..	2,420,000
Value		$66,550
Merchandise:		
Quantity	barrels..	542,700
Value		$4,071,250
Merchandise:		
Quantity	bales..	3,420
Value		$238,400
Live stock:		
Quantity	number..	523
Value		$78,450
Passenger fare		$35,640
Aggregate		$7,029,362
Number of steamers, 1883		6
Value		$110,000
Tonnage		1,500

Draught, 3 to 5 feet.

The decrease in aggregate value of business is mainly to be attributed to the decreased values of nearly all goods transported, as compared with values of the year 1882.

Official.

E. L. WELLS,
Secretary Board of Trade.

M 5.

IMPROVEMENT OF FLINT RIVER, GEORGIA.

The survey for the improvement of Flint River by the General Government was made in November and December, 1872, and completed in February, 1873.

Work of improvement was commenced in November, 1877, below Bainbridge, Ga., by hired labor, and is virtually completed to Maple's Chute, affording good navigation at low water from the mouth of the river to this point, a distance of 60½ miles. The original depth of water on the shoals, which were scattered all along the river, varied from 6 inches to 3 feet, and the width of the channel from 30 to 500 feet.

The obstructions consisted of loose bowlders, solid ledges, and flat reefs, with intervening pools varying in depth from 10 to 20 feet.

The steamers of the Central and People's Line made regular trips from Columbus, Ga., and Apalachicola, Fla., as high up as Bainbridge at low water, but above that point navigation was impossible at low water and extremely hazardous at high water.

The original project, which has been adhered to, contemplated opening a channel 100 feet wide and 3 feet deep at low water.

The gauges were set so that the 0 point of the gauge would correspond to the low water of 1855, the lowest water ever known on this river, the next lowest being on the 28th and 29th of October, 1881, the gauge then reading 3 inches above 0.

In accordance with an act of Congress approved June 18, 1878, an examination was made between December, 1878, and January, 1879, of that division of this river between Albany and Montezuma, Ga., and estimated distance of 100 miles, for the purpose of rendering it navigable by the removal of snags and overhanging trees. In the month of January, 1881, the work of removing snags and cutting overhanging trees was commenced with a snag-boat worked by hand, and the work has been carried on, with only slight interruptions from high water, to the present time.

From Drayton to Montezuma, Ga., an estimated distance of 30 miles, the channel was completely blocked with snags. The average width of this division of the river is 70 feet and the depth sufficient for boats drawing 3 feet, when the obstructions are removed.

Between Drayton and Albany, Ga., there are twenty-four rock shoals requiring improvement, but as there was no survey of these shoals, data for cost of improvement cannot be given.

This entire division of the river will have to be worked over as obstructions in the shape of logs will occur from the caving of banks during high water, but less caving has occurred in the past two years than was expected.

The following tables show the progress made during the fiscal year on each division of the river:

BETWEEN ALBANY AND MONTEZUMA.

Number of miles worked over during fiscal year	12
Total number of miles worked over	25½
Number of snags removed during fiscal year	3,853
Number of overhanging trees cut during fiscal year	250
Total number of snags removed	8,291
Total number overhanging trees cut	867
Number of miles to be worked to reach Montezuma	4½

BELOW ALBANY, GEORGIA.

Number of barges built	1
Number of miles worked over	1½
Number of miles to be worked over	50½
Number of miles wholly improved	60½
Linear feet of holes drilled	2,618
Number of blasts made	695
Average charge of powder, pounds	2
Average charge of dynamite, pound	½
Cubic yards of rock removed	2,439
Number of snags removed	101

NAMES OF SHOALS WORKED ON IN FISCAL YEAR ENDING JUNE 30, 1883.

Hell Gate, finished.
Sycamore, finished.
Maple's Chute, finished.

Pounds of powder used	727
Pounds of dynamite	280

Table showing condition of the improvement on the 30th of June, 1883, below Albany, Ga.

Names of places.	Above Chattahoochee, Fla.	Below Albany, Ga.	Original depth.	Present depth.	Original width.	Present width.
	Miles.	*Miles.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Lambert's Island	23	88	1	3	0	100
Rob s Rock	26	85	0	2	60	100
Broad Axe Rock	26½	84½	½	4	50	100
Bryant's Rock	31½	79½	½	4	70	100
Versailles Rock	34	77½	½	4	50	100
Bainbridge	36	75	1	4	100	100
Three Rock Reach	39	72	½	4	40	100
Below Cross Chute	40	71	½	4	20	100
Cross Chute	47	64	0	4	75	100
Fodder Stack Shoal	48	63	0	3	80	100
Reefs 1 to 12	48 to 57	63 to 54	1	3	40	100
Crawford's Point	57	54	0	3	70	100
Winding Shoals	58	53	1	3	40	100
Hell Gate Shoals	59½	51½	0	3	0	100
Sycamore Shoals	60	51	1	3	40	100
Maple Chute	60½	50½	0	3	20	100

The condition of the division of the river between Albany and Montezuma, Ga., on the 30th day of June, 1883, is such that at low water steamers drawing 3 feet of water can run from the mouth of Swift Creek to within 4½ miles of Montezuma, an estimated distance of 55½ miles, and when completed to Montezuma, I am assured by the Board of Trade of that town that a steamer will be placed upon it.

It is proposed to expend the funds available for the fiscal year ending June 30, 1884, to pushing forward the work in the direction of Albany by working upon the following shoals: Keating Shoals, Hopkins Obstructions, Bull's Slough, Rope Work Shoals, Dickerson's Shoals, and two reefs between Rope Work and Dickerson's, Buck Shoals and Sisters Island Shoals, which brings us to Newton, from which point a large trade will be developed.

On the division between Albany and Montezuma the work will be completed to Montezuma, and then the river be reworked to the mouth of Swift Creek, removing such timber as may have fallen into the river or been uncovered since the commencement of the work.

The sum of $25,000 can be profitably expended during the fiscal year ending June 30, 1885, by pushing the work forward in the direction of Albany, Ga., so as to open up the river to the large trade which will be developed along its entire length. Everything is now hauled by wagons to railroad, a distance of 20 miles.

The sum of $50,000 could be profitably expended on that division of the river between Albany and Montezuma, Ga., by the removal of snags, cutting overhanging timber, &c., thus rendering this portion of the river navigable and affording cheap transportation to the large crops made upon its banks. A greater portion of the crops are now hauled by wagons, a distance of from 20 to 30 miles, to a railroad.

A saving in freights by water transportation over railroad rates would in a few years pay the entire cost of the improvement.

It is believed that the original estimate of $175,000 will be sufficient to complete the work from Maple's Chute to Albany, Ga.

The improvement will be nearly permanent, and an annual expenditure of $2,000 for five years after its completion is deemed sufficient for its maintenance.

For the removal of snags between Albany, Ga., and Montezuma about $25,000 will be sufficient to complete the work according to the present adopted project, and an annual expenditure of $5,000 for an indefinite time will be necessary to maintain it, as the river traverses for 30 miles a densely timbered swamp, and fresh snags will be continually precipitated into the channel by the caving banks.

Money statement.

July 1, 1882, amount available	$2,797 21
Amount appropriated by act passed August 2, 1882	25,000 00
	27,797 21
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	16,525 68
July 1, 1883, amount available	11,271 53
Amount (estimated) required for completion of existing project	127,829 52
Amount that can be profitably expended in fiscal year ending June 30, 1885	75,000 00

COMMERCIAL STATISTICS.

The following table shows the business done by the steamboats on the Flint River below Bainbridge, Ga., for the year ending June 30, 1883:

Fertilizers:		
Quantity	tons	4,760
Value		$214,200
Iron:		
Quantity	tons	520
Value		$39,520
Cotton:		
Quantity	bales	19,470
Value		$876,150
Grain:		
Quantity	bushels	25,240
Value		$20,192
Timber:		
Quantity	feet	617,000
Value		$16,967
Merchandise:		
Quantity	barrels	212,300
Value		$1,592,250
Merchandise:		
Quantity	bales	962
Value		$67,340
Live stock:		
Quantity	number	38
Value		$5,320
Value of passenger fare		$6,720
Aggregate in dollars		$2,948,659
Number of steamers in 1883		6
Value		$110,000
Tonnage		1,500

Draught, 3 to 5 feet.

The following table shows the business done by boats on the Flint River above Bainbridge, Ga., for year ending June 30, 1883:

Sawn lumber, by raft:		
Quantity	feet	6,000,000
Value		$75,000
Square and round logs, by raft:		
Quantity	feet	36,000,000
Value		$360,000
Rosin:		
Quantity	barrels	20,800
Value		$41,600

Spirits of turpentine:		
Quantity	barrels..	4,192
Value		$83,840
Aggregate in dollars		$563,740
Number of steamers in 1883		1
Value		$2,500
Tonnage		30
Draught, 1 to 3 feet.		
Number of flat boats in 1883		1
Value		$800
Tonnage		30
Draught, 1 to 2½ feet.		

M 6.

IMPROVEMENT OF APALACHICOLA RIVER, FLORIDA.

This improvement was commenced in December, 1874, the steam snagboat Clara Dunning being employed in removing logs and overhanging timber. The depth of water was sufficient, as well as the general width from bank to bank, but its availability for purposes of commerce was bad, in consequence of numerous snags.

The old river at Virginia Bend, 50 miles above Apalachicola, was completely closed for a distance of 6 miles, and the only chance for navigation was through Moccasin Slough, which was very crooked and narrow and badly obstructed with snags and overhanging timber; so much so that it required several days for a boat to work through.

The original project of improvement contemplated a channel 100 feet wide and 6 feet deep at low water, to be secured by removing snags and overhanging trees, as well as widening and straightening Moccasin Slough, and no change has been made in the original design.

The improvement may be considered completed as projected, the river being in good navigable condition and only requiring the removal of the annual accumulation of snags and overhanging trees and such work as can be done with the amount, $2,000, which has been estimated as necessary annually for preserving the improvement.

In addition to the first project, Chipola Cut-Off has been opened to White's Bluff, on Chipola River, a distance of 9 miles.

During the fiscal year ending June 30, 1883, the operations were confined to the removal of a large drift that had accumulated at Moccasin Slough.

It is proposed to use the amount available and amount that may be appropriated in preserving the improvement by removal of snags, drift, and overhanging trees, and the improvement of the upper end of Moccasin Slough, so as to render the upper entrance easier of access.

Money statement.

July 1, 1882, amount available	$2,129	84
Amount appropriated by act passed August 2, 1882	2,000	00
	4,129	84
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	806	87
July 1, 1883, amount available	3,222	97
Amount (estimated) required preservation of improvement annually	2,000	00
Amount that can be profitably expended in fiscal year ending June 30, 1885	2,000	00

M 7.

IMPROVEMENT OF APALACHICOLA BAY, FLORIDA.

A survey for this improvement was provided for by act of Congress approved July 11, 1870. Report of the survey is contained in the Annual Report of the Chief of Engineers for 1872, pages 612 to 623. A re-examination was made in December, 1878, report of which is contained in Annual Report of the Chief of Engineers for 1879, pages 823 to 824.

The plan adopted consists in dredging a channel through the bar at the mouth of Apalachicola River 100 feet wide and 11 feet deep at mean low water, following the natural line of deepest water.

The estimated cost of the work was $100,000.

The following appropriations have been made:

By act of Congress approved June 14, 1880	$10,000
By act of Congress approved March 3, 1881	10,000
By act of Congress passed August 2, 1882	25,000
	45 000

The work was commenced in December, 1881, under a contract with W. A. Alexander, and continued under contracts with John Tomlinson and John McGuire.

The work done during the last fiscal year was dredging out material that had filled in the cut previously made, widening the 30-foot cut mentioned in last annual report to 60 feet, and extending it to a depth of 9½ feet on the outer slope of the bar, and in making an additional cut of 15 feet width through the bar.

The cut has now a width of 75 feet, but is only extended through from the 11-foot curve inside to the 9½-foot curve outside. The least depth is 9½ feet.

The execution of the work has been unsatisfactory.

Filling has taken place in the cut made under previous contracts, but may have been caused by leaking scows towing through the channel, or by the material being dumped too near the cut.

It is believed that when the cut has been widened sufficiently and carried through the bar to the full depth of 11 feet it will be reasonably permanent, provided the dredged material is dumped at a sufficient distance.

This improvement is located in the collection district of Apalachicola, and Apalachicola is the port of entry.

A decided improvement has already taken place at this port since the improvement was commenced, and it is believed that a successful completion of it will produce such an increase in the commerce and prosperity of Apalachicola as will show the appropriation to have been wisely made.

Money statement.

July 1, 1882, amount available		$94 95
Amount appropriated by act passed August 2, 1882		25,000 00
		25,094 95
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$22,227 56	
July 1, 1883, outstanding liabilities	2,209 34	
		24,436 90
July 1, 1883, amount available		658 05
Amount (estimated) required for completion of existing project		55,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.		55,000 00

Abstract of bids received and opened September 14, 1882; *dredging at Apalachicola Bay, Florida.*

No.	Names of bidders.	Price.	Date of commencement.	Date of completion.
		Pr. cu. yd.		
1	Geo. C. Fobes & Co	$0 26	In accordance with specifications.	In accordance with specifications.
2	John Maguire	22½	....do	Do.
3	S. N. Kimball	23	Immediately	Continue the work to completion.

COMMERCIAL STATISTICS.

The following commercial statistics have been furnished:

Commercial statistics of port of Apalachicola for fiscal year ending June 30, 1881.

	Vessels.	Tons.
Coastwise arrivals	36	8,232
Coastwise clearances	49	11,803
American vessels entered	11	2,821
Foreign vessels entered	1	,553
American vessels cleared	6	1,272
Foreign vessels cleared	2	1,018
Total	105	25,699

Value of imports	$373 00
Value of exports	17,102 00
Revenue collected	3,103 70
Total	20,578 70

Commercial statistics of the port of Apalachicola for the fiscal year ending June 30, 1883.

	Vessels.	Tons.
Coastwise arrivals	39	10,918
Coastwise clearances	44	14,564
American vessels entered	7	1,601
Foreign vessels entered	33	18,128
American vessels cleared	4	,843
Foreign vessels cleared	31	16,802
Total	158	62,856

Value of imports	$437
Value of exports	143,864
Revenue collected	5,898
Total	150,199

SAMUEL P. WREFORD,
Special Deputy Collector.

RECEIPTS AND SHIPMENTS FROM JULY 1, 1882, TO JUNE 30, 1883.

RECEIPTS.

Miscellaneous merchandise		$369,000
Machinery		20,000
Produce and sponge		27,000
Cypress and pine logs	10,000,000 ..	60,000
Pine hewn timber	12,000,000 ..	120,000
Palmetto logs	1,000 logs ..	900
		596,900

SHIPMENTS.

Fish, oysters, sirup, oranges, &c		$60,000
Potatoes, sponge, barrels, and wood		17,500
Miscellaneous merchandise		190,000
Timber, lumber, &c:		
Lumber (foreign)	1,000,000	10,000
Lumber (coastwise)	12,000,000	120,000
Timber (foreign)	11,000,000	133,000
Palmetto logs (coastwise)	1,000	900
Shingles	1,500,000	3,750
Guano	300 tons	10,000
Salt	1,200 sacks	10,000
		555,150

RECEIPTS AND SHIPMENTS FROM JULY 1, 1880, TO JUNE 30, 1881.

RECEIPTS.

Miscellaneous merchandise		$250,000
Machinery		10,000
Produce and sponge		10,000
Cypress and pine logs, 6,000,000 feet B. M		36,000
Pine and hewn timber, 1,000,000 feet B. M		*8,000
Palmetto logs, (2,000 logs)		1,600
		315,600

SHIPMENTS.

Fish, oysters, sirup, oranges, &c		$35,000
Potatoes, sponges, barrels, and wood		12,000
Miscellaneous merchandise		62,000
Timber, lumber, &c.:		
Lumber (foreign)	400,000 feet B. M.	4,000
Lumber (coastwise)	8,000,000 feet B. M.	80,000
Timber (foreign)	1,300,000 feet B. M.	13,000
Palmetto logs (coastwise)	2,000 logs	2,500
Shingles (coastwise)	500,000	1,250
		209,750

The above is estimated as near as possible.

List of vessels employed in Apalachicola Harbor, Florida, from June 30, 1880, to June 30, 1881.

Name.	Tonnage.	Draught.	Name.	Tonnage.	Draught.
SCHOONERS.		*Feet.*	PADDLE STEAMERS.		*Feet.*
H. Brash	42.69	6	G. G. Jordan *	228.16	4
Jessie May	6.25	2	F. H. Moore *	250.78	4
Liberty	6.92	2	Newton	49.37	2
Mary Ann	5.84	2	Wylly*	162.02	3
Golden Age	5.72	2	Everingham	292.02	4
Ida Lee	5.73	2	St. Clair*	174.02	5
California	16.67	4			
Hattie	6.78	2	SCREW STEAMER.		
Frances Miller	8.13	2			
Clara	7.53	3	Hudson Pet	14.39	4
Angelina	8.87	3			
Chas. Pearce	5.68	3	SLOOPS.		
Wm. Crawford	9.05	4			
Lonimo	5.40	2	John Edward	11.08	4
Alice	6.93	$2\frac{5}{10}$	Carrie	6.38	3
Rosina	10.70	4	Lillie Allen	5.13	2
Minnie Grey	8.34	3			
Gazelle	8.34	3	BARGES.		
John H. Hoffman	13.91	4			
John G. Ruge	15.36	4	One †	400.00	3
A. O'Connor	5.81	2	....do	360.00	3
			....do	300.00	3
			....do	500.00	$4\frac{4}{10}$

Total number of vessels, 35; tons, 2,970.25.

* Since abandoned. † Tonnage of barges estimated.

CUSTOM-HOUSE, APALACHICOLA, FLA.,
May 8, 1883.

I hereby certify that the above is a true statement of vessels employed in Apalachicola Harbor, Florida, as near as I can ascertain.

SAMUEL P. WREFORD,
Special Deputy Collector.

List of vessels employed in Apalachicola Harbor, Florida, from July 1, 1882, *to June* 30, 1883.

Name.	Tons.	Draught.	Name.	Tons.	Draught.
SCHOONERS.			Everingham	292. 02	4
			Chattahoochee	436. 92	4
H. Brash	42 69	6	Caddo Belle	175. 27	3
Jessie May	6. 25	2	Thnonatuska	197. 13	3
Liberty	6. 92	2	C. Emlen	128. 90	4
Mary Ann	5. 84	2			
Golden Age	5. 72	2	STEAMERS, SCREW.		
Ida Lee	5. 73	2			
California	16. 67	4	Belle Sparks	45. 66	5
Hattie	6. 78	2	Lottie	49. 27	6
Frances Miller	8. 13	2	Hudson Pet	14. 39	4
Clara	7. 53	3	Ella Wood	41. 09	5
Angelina	8. 87	3	B. L. Curtis	23. 09	4
Chas. Pearce	5. 68	3	M. Brash	39. 48	4
Wm. Crawford	9. 05	4	Sylvan Dell	53. 08	3
Lonmio	5. 40	2	Chamberlain	31. 91	$7\frac{5}{10}$
Alice	6. 93	$2\frac{5}{10}$			
Rosina	10. 70	4	SLOOPS.		
Minnie Grey	8. 34	3			
Jessie May	6. 25	2	John Edward	11. 08	4
Gazelle	8. 34	3	Lillie Allen	5. 13	2
John H. Hoffman	13. 91	4			
John G. Ruge	15. 36	4	BARGES.		
A. O'Connor	5. 81	2			
Geo. S. Hawkins	36. 34	5	One	400. 00	3
Big Bazoo	12. 24	6	....do	360. 00	3
Mary Louise	9. 02	4	....do	300. 00	3
			....do	500. 00	4
STEAMERS, PADDLE.			....do	250. 00	3
			....do	200. 00	3
Newton	49. 37	2	....do	350. 00	3
Wylly	162. 02	3			

Total number of vessels, 49; tons, 4,390. 31.

M 8.

IMPROVEMENT OF TAMPA BAY, FLORIDA.

The object of this work is to facilitate navigation to the town of Tampa, the approach to which is a narrow and shallow channel through the upper bay, 5.5 feet being the depth at mean low water.

In 1881, under an appropriation of $10,000, 18,530 cubic yards of material were excavated, deepening and partially straightening it for 2,900 feet in length, 9 feet deep, and 60 feet wide.

During the fiscal year ending June 30, 1882, under an appropriation of $10,000, 30,709 cubic yards were dredged for a distance of 5,315 feet, giving under both appropriations 49,239 cubic yards of material removed, securing a cut 8,215 feet in length and 60 feet in width.

During the fiscal year ending June 30, 1883, 19,161 cubic yards of material (of which 2,470 cubic yards were rock) were removed by blasting and dredging.

Sixty-eight thousand four hundred and fifty cubic yards of material (including 2,470 of rock) have been removed by blasting and dredging since the beginning of this work. There is now a fair, though somewhat narrow channel, 9 feet depth way through to the wharves at Tampa with the exception of two small shoals below Spanish Town Point and

that portion of the channel extending from a point about 300 feet north of Spanish Town Creek to a point about 300 feet below the upper curve, a distance of about 1,000 feet where there is now but 7½ feet.

The work performed during the last fiscal year has been the cutting of a channel by blasting and dredging through the ledge of rocks at the mouth of the river, 9 feet deep at mean low water, and over 75 feet wide.

From a point about 500 feet below Spanish Town Point to a point about 300 feet north of Spanish Town Creek the channel has been widened to 55 feet width, a depth of 9 feet at mean low water.

All the points in the channel have been cut through slightly, particularly that at Spanish Town Point.

Any appropriation that might be made available in the future should be used in dredging those portions of the channel previously reported as having less than 9 feet and the widening of the whole channel.

The permanency of the channel is still an unsettled question. There has been apparently a partial filling of the channel excavated during previous years, but it is not known whether this has been due to improper execution of the work, to the fact that the channel is too narrow, or whether a cut, however well made or wide, will have the same tendency to fill.

Money statement.

Amount appropriated by act passed August 2, 1882	$20,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	20,000 00
Amount (estimated) required for completion of existing project	57,002 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	57,002 00

Abstract of bids received and opened September 30, 1882, for dredging at Tampa Bay, Florida.

No.	Names of bidders and subject of bid.	Price.	Date of commencement.	Date of completion.
		Pr. cu. yd.		
1	Geo. C. Fobes & Co.:			
	Earth	$0 31	In accordance with specifications.	In accordance with specifications.
	Rock	9 00		
2	S. N. Kimball:			
	Earth	29	....do....	Do.
	Rock	6 85		
3	John Maguire:			
	Both earth and rock	99½	....do....	Do.
4	Rittenhouse Moore:			
	Earth	30	....do....	Do.
	Rock	9 75		

COMMERCIAL STATISTICS.

The following are the steamships owned and employed by the Tampa Steamship Company in the carrying trade to Tampa, Fla., during the year 1882:

Name.	Gross tonnage.	Draught, loaded.
		Feet.
Chase, propeller	576	15
Lucy P. Miller, propeller	533	13
Lizzie Henderson, propeller	281	9
I. J. Cochran, propeller	230	9
Amite, propeller	230	8
Alabama, side-wheel	750	7

Imports into Tampa, Fla., by the Tampa Steamship Company, year 1882.

Apples	barrels	108
Axle-grease	cases	57
Boots and shoes	boxes	634
Beans	barrels	50
Bagging	rolls	40
Bread preparation	cans	232
Bacon:		
Casks		3
Boxes		350
Tierces		54
Barrels		62
Bran	sacks	419
Blinds and sash	packages	156
Bricks	number	2,150
Bells, church	do	2
Beer:		
Barrels		206
Kegs		20
Bellows	number	6
Barrows, wheel	do	48
Butter:		
Tubs		114
Kegs		180
Fruit	crates	35
Belting	rolls	16
Baskets	packages	57
Brooms	do	101
Buggies	number	60
Building stones	do	20
Cheese	boxes	298
Crackers and bread:		
Boxes		186
Barrels		523
Coffee:		
Cases		39
Sacks		912
Cigars	cases	110
Can goods	do	1,312
Corn-mills	number	4
Castings	packages	199
Cider	barrels	64
Corn	sacks	4,265
Candy	pails	78
Candy	boxes	362
Cement	barrels	55
Coffee-mills	cases	51
Crockery:		
Hogsheads		92
Cases		221
Barrels		87
Candles	boxes	51
Crate stock	bundles	158
Coffins	number	48
Drugs	cases	743
Dogs	number	3
Doors:		
Number		302
Packages		9
Dry-goods and domestics:		
Cases		392
Bales		176
Fruit, dried	packages	215
Flour	barrels	4,974
Furniture, old and new	p'k'ges	2,063
Fish:		
Kegs		16
Cases		64
Forges	number	1
Farming tools and implements, pieces and packages		582
Fertilizers:		
Barrels		266
Sacks		492
Furnaces, clay	number	16
Fruit-trees	packages	110
Grits	barrels	1,300
Groceries	packages	1,436
Gins	number	1
Granite	pieces	21
Grindstones	number	187
Hay:		
Bales		588
One-half bales		99
One-third bales		415
One-quarter bales		50
Hardware	packages	1,591
Hats	cases	174
Horses	number	72
Home finishing stuff	packages	35
Ice	barrels and boxes	188
Iron safes	number	13
Liquors	barrels	133
Lumber	feet	8,254
Lathes	number	1
Lath machines	number	1
Lard:		
Tierces		73
Boxes and kegs		128
Lime	barrels	206
Matches	cases	183
Machines, sewing	number	138
Machinery, mill	packages	270
Merchandise:		
Cases		1,254
Packages		848
Meal, corn	barrels	470
Meal, oat:		
Barrels		6
Cases		82
Marble	pieces	13
Millstones	number	2
Nails	kegs	1,210
Nuts:		
Barrels		68
Bags		62
Oats	sacks	1,920
Onions	barrels	227
Oil:		
Barrels		231
Cases		294
Oakum	bales	24
Organs and pianos	number	30
Pickles	boxes	161
Putty	kegs	1
Pumps	number	6
Pork	barrels	58
Powder	kegs	103
Pease:		
Barrels		4
Sacks		116
Pails, washboards, and tubs, packages		350
Paper	packages	394
Potash, soda, and lye	cases	383

Imports into Tampa, Fla., by the Tampa Steamship Company, year 1882—Continued.

Potware...	pieces and packages..	1,112	Sugar	barrels..	240
Potatoes	barrels..	538	Stoves	number..	437
Paint:			Stove pipe	crates..	18
Barrels		23	Saws	number..	31
Cases		52	Starch	boxes..	155
Kegs and pails		428	Snuff:		
Plaining machines	number..	3	Boxes and jars		57
Pigs	do...	2	Barrels		2
Pans, sugar	do...	8	Trunks	number..	204
Rice	barrels..	140	Tinware	cases..	66
Rope	coils..	133	Tobacco:		
Rollers, sugar	number..	28	Boxes		773
Rye	sacks..	5	Casks		418
Sash weights:			Twine	packages..	16
Single		113	Tobacco	cases..	91
Packages		52	Telegraph stuff	do...	7
Soap	boxes..	659	Tin	do...	23
Salt:			Vises	number..	2
Barrels		61	Vinegar	barrels..	25
Sacks		245	Wagons	number..	23
Saddling	cases..	149	Wire	rolls..	87
Shingles	M..	29¾	Wagon stock	packages..	545
Shot	sacks..	126			

MEMORANDA OF EXPORTS OF THE TAMPA STEAMSHIP COMPANY FROM TAMPA, FLORIDA, DURING THE YEAR 1882, EXCEPT CATTLE.

Oranges, lemons, limes, green fruit, and vegetables	crates		23,433
	barrels		1,253
Sea-island cotton		bales..	411
Hides and skins		do...	203
Sirup		barrels..	137
Sugar		do...	129
Chickens		coops..	70
Merchandise		packages..	1,442
Eggs		boxes..	40
Cedar pencil-wood, 50 gross each		do...	1,188
Wood		bales..	31
Fish		barrels..	15
Beeswax		packages..	7

J. DARLING,
Agent of Steamship Company at Tampa.

TAMPA, FLA., *April* 6, 1883.

M 9.

IMPROVEMENT OF SUWANNEE RIVER, FLORIDA.

The examination of this river was provided for by act of Congress approved June 18, 1878. It was made from the bridge of the Jacksonville, Pensacola and Mobile Railroad to the Gulf, through both East and West passes.

The improvement found to be needed was the deepening of the channel over the bars at the passes by dredging, the removal of snags and overhanging trees along the river and the deepening and improvement of the river at various localities by the removal of rocks and construction of dams so as to straighten, widen, and deepen the channel.

The depth to be obtained was 5 feet through the bars at the passes and up the river as far as Roland's Bluff, and from there up to Ellaville 4 feet.

The estimated cost of the improvement was $55,158.

The following appropriations have been made:

Act approved June 14, 1880	$5,000
Act approved March 3, 1881	3,000
Act passed August 2, 1882	5,000
Total	13,000

The improvement of East Pass was first undertaken, as it was believed to be for the best interest of the commerce of the river.

Work was commenced November, 1881, under two contracts, that of James E. Slaughter and John Tomlinson.

During the fiscal year ending June 30, 1882, 17,026 cubic yards of material were removed, giving a channel of 65 feet wide and 6 feet depth, 1,409 feet long. This exhausted the first two appropriations.

Bids for dredging under the last appropriation were opened September 30, 1882, and the contract was awarded to S. N. Kimball, the lowest bidder, October 7, 1882, work to commence February 25, 1883. An extension was granted to May 25, and again to August 25, consequently no work has been accomplished during the fiscal year.

The work will not probably be permanent in its character, but will require a small appropriation each year to preserve it.

No commercial statistics could be procured, but probably have not changed much since 1882, when the following statement was prepared from information obtained by the assistant engineer in charge.

STEAMBOATS PLYING THE SUWANNEE.

Era, 60 tons, drawing 3 feet, with a barge for wood.
Yulee, 50 tons, drawing 3 feet, with a barge for wood.
Shafer, 60 tons, drawing 4 feet, with a barge for wood.
Eric, 40 tons, drawing 4 feet.

Rafts of saw-logs, pine, to the extent of 5,000,000 feet of lumber, board measure, and 220,000 cross-ties have been floated or towed down the river to Cedar Keys, where the logs have been converted into lumber, the ties shipped to Mexico. The quantity of cedar, or of farm products, or of general commerce could not be ascertained; an increase in all is evident from the greater animation in business and the largely increasing freights.

Money statement.

July 1, 1882, amount available	$204	01
Amount appropriated by act passed August 2, 1882	5,000	00
	5 204	01
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	414	34
July 1, 1883, amount available	4,789	67
Amount (estimated) required for completion of existing project	42,158	00
Amount that can be profitably expended in fiscal year ending June 30, 1885	42,158	00

Abstract of bids received and opened September 30, 1882, for dredging at Suwannee River, Florida.

No.	Names of bidders.	Price.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	John Maguire	$0 60	Within four months.	Within one year.
2	S. N. Kimball	50	In accordance with specifications.	In accordance with specifications.

M 10.

IMPROVEMENT OF CHOCTAWHATCHEE RIVER, ALABAMA AND FLORIDA.

The improvement of this river was begun in November, 1874, an appropriation of $5,000 having been made by Congress for that purpose.

A log-boat 20 by 60 feet was constructed, and 35 miles of river, from the mouth at Mitchell's River up-stream, were improved. Operations were suspended in March, 1875.

A new appropriation of $5,000 having been made, work was resumed in May, 1875, and continued until September of the same year, and 25 miles more of river up-stream were improved.

Another appropriation of $5,000 was made in 1877, and work resumed and continued until August, 1877; 30 miles more of river up-stream were improved.

Owing to washing and caving in of banks, caused mostly by freshets and the injurious practice of driving loose saw-logs and timber down the river to its mouth, that portion of the river previously improved had to be worked over again, so as to give relief to navigation.

An appropriation of $5,000 was made in 1878, but could not be used until 1880, when an additional sum of $7,000 was appropriated, and with this amount, $12,000, operations were resumed in January, 1880, and continued until April, 1881; 40 miles more of river up-stream were improved, carrying the improvement to within 10 miles of Geneva, then the head of navigation.

Nearly all that portion of river previously improved had, owing to the causes before mentioned, to be worked over again.

Three steamboat wrecks were found in this part of the river, and two of them, the Boston and the Edwards, were completely removed, and the wreck of the Eighth of January was partly removed.

The original project under which work was begun in 1874 was for removing obstructions from the mouth of the river at Mitchell's River, Florida, to Geneva, Ala.

The channel through the mouth at Mitchell's River becoming too shoal for navigation in 1878, and another mouth, that of Cypress Top, having deepened, this mouth was partly improved by the removal of sunken logs, trees, &c., and 4 feet 3 inches of water was obtained.

This mouth has since been used exclusively by boats propelled either by steam, sail, or poles.

In 1881 the sum of $10,000 was appropriated, and the original project for the improvement of this river was changed in so far as to expend one-half of this amount in continuation of the work under the original project, and the other half on the improvement of the river from Geneva towards Newton, Ala., the improvement of this part of the river, however, to be for high-water navigation only.

When work on the improvement of the river was first commenced, in 1874, the river was, although having an average width of 350 feet, almost totally obstructed, admitting only narrow barges and flats of light draught of water to be navigated, and the channel, if a channel existed at all, was such as to be extremely dangerous to navigation, particularly during the summer months, the river then being at its lowest stage.

In the lower half of the river, that is, from the mouth to Douglassville, although there was an ample depth of water for navigation purposes, even during the lowest stage, yet the channel was so obstructed by

snags, stumps, logs, sunken and overhanging trees, that boats were in almost every instance obliged to cut their way through, making navigation extremely slow and dangerous.

On the upper part of the river there was at a low stage of water an average depth of 2 feet, obstructed, however, by snags, stumps, logs, sunken and overhanging trees, sand and gravel bars, rock shoals, and steamboat wrecks, so as to be navigable practicably only during very high river, and merchants and farmers were obliged, and in fact preferred, to haul their goods and produce to and from the nearest railroad station, generally a distance of from 50 to 80 miles, rather than take the risk and uncertainty of river transportation.

During the year 1852 the States of Alabama and Florida appropriated as reported, the sum of $40,000 for the improvement of the river from Geneva to the mouth.

The work was let out by contract. The contractor, Mr. Chapman, commenced at Geneva during high water, and, running through the work in three months, cut away and removed only such obstructions as were in the way of high-water navigation.

Choctawhatchee River flows through the counties of Washington, Walton, and Holmes, Florida, and Geneva, Barbour, Dale, and Pike, Alabama, which, with their adjoining counties, are all rich cotton, sugar, and timber counties.

Before the late war several steamboats, besides numerous other crafts, navigated this river. It was, consequently, nearly always kept in a tolerably good navigable condition, but during and since the war, up to 1875, this river, although a stream of considerable size, having an average width of 350 feet, draining a large and fertile portion of Alabama and Florida, and being susceptible of improvements so that 5 feet of water can safely be carried at all seasons of the year, was greatly neglected as far as navigation was concerned.

An appropriation of $20,000 was made for the fiscal year 1882–'83, $12,000 of which to be expended in the improvement of the river from Geneva towards Newton, Ala., $6,000 to be expended on the improvement of the river below Geneva, and $2,000 to be expended on the improvement of La Grange Bayou to the town of Freeport, Fla.

It had been expected that the river would become low enough during the early part of the summer to cut a channel through a rock shoal situated about 4½ miles south of Geneva, this shoal being very troublesome in low water. The log-boat was therefore kept near that locality in anticipation of that work, but owing to steady rains, which kept the river full nearly all the summer and fall, that project had to be abandoned for the present. The small amount that had been reserved for this work from the appropriation of 1881 and 1882, was therefore expended in the removal of snags, trees, &c., between the shoal and Geneva.

Under the new appropriation of $20,000, operations were resumed both above and below Geneva in October, 1882.

No operations were commenced at La Grange Bayou, Fla.

The log-boat was carried up the river above Geneva and work resumed where left off last spring. In consequence of a very heavy storm and high freshet in September, considerable work had to be done while ascending the river in that part improved last year.

During the working season 24 miles of river were wholly improved, 29 miles were partly improved and require to be worked over again, and 25 miles, from Claybank Creek to Newton, remain yet to be improved, the only work done in the latter part of the river being the removal

of nine sunken and one hundred and forty-three overhanging trees during the latter part of May.

The amount of work done during the year on the river between Geneva and Newton is as follows:

Number of snags removed	595
Number of stumps removed	451
Number of roots removed	387
Number of sunken trees removed	1,545
Number of logs removed	399
Number of overhanging trees removed	9,544
Number of yards of bank protected with brush, willows, &c	4,660
Number of sloughs closed up	6

Operations on the improvement of the river below Geneva were continued during the early part of the fiscal year with the log-boat, but as this is the only log-boat on hand, and was taken up the river for work between Geneva and Newton, the steamer Peerless was chartered for two months, to be used on the work of improvement. This step was necessary in order to give immediate relief to navigation between Rouxe's Bluff and Geneva, the storm and freshets of September having left that part of the river almost impassable.

The work done with the steamer consisted, however, only in the removal of such obstructions as were mostly in the way of navigation, and extended over a distance of 132 miles, and requires to be worked over again.

During the months of January, February, March, April, and part of May, 1883, the river was too high below Geneva to work to advantage and operations were temporarily suspended.

During the latter part of May, 1883, the log-boat having been thoroughly overhauled and strengthened, operations were again resumed with log-boat at Half Moon Bluffs, working up-stream towards Geneva.

During the working season 10 miles of river below Geneva were wholly improved, and 122 miles were partially improved and require working over again.

The amount of work done during the working season of the fiscal year is as follows:

Number of snags removed	163
Number of stumps removed	99
Number of roots removed	54
Number of logs removed	87
Number of sunken trees removed	368
Number of overhanging trees removed	1,382
Number of yards of bank protected with brush, &c	280
Number of cubic yards of sand removed	70
Number of trees, logs, &c., removed	1

The total amount of work performed during the fiscal year in both sections of the river is as follows:

Number of miles wholly improved	34
Number of miles partially improved and require working over again	161
Number of miles remaining to be improved	25
Number of snags removed	758
Number of stumps removed	550
Number of roots removed	441
Number of logs removed	486
Number of sunken trees removed	1,913
Number of overhanging trees removed	10,926
Number of yards of bank protected	4,940
Number of cubic yards of sand removed	70
Number of sloughs and cut-offs closed	6
Number of large drifts removed	1

The condition of this river from the mouth to the present head of navigation, at Claybank Creek, a distance of 220 miles, is such as to allow boats of 4½ feet draught of water to navigate at all times during a medium stage of river, as far as Geneva, Ala.

Boats of 2 feet draught of water can navigate from Geneva to Claybank Creek at a medium stage of river, and during full river 5 feet of water can safely be carried to that point.

Wherever sunken trees and logs have been removed, the channel has deepened 2 and 3 feet, and even more at different places.

Wherever sand has existed, at and behind points, and the sunken trees, brush, drift, &c., that held the sand, were removed so as to allow the current to follow its natural course, these sand-bars have washed away into deep holes without shoaling any other portion of the river, and where, before the improvement, scarcely 4 or 5 inches of water existed, 3 and 4 feet are now found.

The width of the river, therefore, as well as the depth of the water, has been increased in nearly one-third of the total distance of the stream.

Since the completion of the Pensacola and Atlantic Railroad, navigation, from Geneva down, has been confined exclusively between that place and the railroad station at Half-Moon Bluff, a distance of 40 miles; nothing but rafts and drives of saw-logs, and square timber going below the station.

Below the railroad station down to Holmes Creek, a distance of 72 miles, no boats are navigating the river at present.

From Holmes Creek down to the mouth of the river, a distance of 50 miles, a number of craft of different descriptions, are navigating, connecting with Pensacola. This part of the river is in an excellent condition, and boats drawing 5 feet of water, or all that can be carried over the bar at the mouth, can safely navigate at all times of the year, even at the lowest stage of water.

Several barges have recently been constructed at Geneva to be placed on the upper river between Geneva and Claybank Creek, to extend their trips, if possible, next winter as far as Newton. It is also contemplated to place a light-draught steamer on this line to run in connection with the railroad.

It is proposed to apply the funds available for expenditure during the fiscal year ending June 30, 1884, to the entire and thorough improvement of that part of the river between Geneva and the railroad station at Half-Moon Bluff, 40 miles, so that boats of 4½ feet draught of water can navigate safely between these points at all seasons of the year, day and night, and during the lowest stage of water.

This work consists in the complete removal of snags, logs, sunken and overhanging trees, &c., the cutting of a channel 60 feet wide, through a rock shoal situated 4½ miles south of Geneva, the removal of a gravel bar 10 miles south of Geneva, and the removal of some loose rocks and bowlders at Half-Moon Bluff.

To the further improvement of that part of the river from Geneva to Newton, Ala., the approximate distance being 80 miles.

This work consists of the working over of that part of the river previously improved (55 miles), and the improvement of the river between Claybank Creek and Newton, Ala. (25 miles).

The principal obstructions in this part of the river were snags, logs, stumps, sunken and overhanging trees, &c. Three fish-traps situated at intervals of 1 and 2 miles, a short distance south of Newton, are also in the way of high-water navigation and should be removed.

The results that may be expected from these improvements are the widening and deepening of the channel from the railroad station at Half-Moon Bluff to the town of Newton, a distance of 120 miles, so that boats of 4½ feet draught of water can navigate the entire length of this part of the river during eight months of the year. During the other four months boats of 4½ feet draught of water could navigate only as far as Geneva, where connections with lighter-draught boats will be made as far as Claybank Creek, this part of the river (between Geneva and Newton) being improved only for high-water navigation.

The benefits to commerce that may be expected from these improvements are as follows: The towns of Geneva, Newton, Ozark, Elba, and numerous other towns near the Choctawhatchee River are now placed in semi-weekly connection with the railroad station at Half-Moon Bluff by steamers. Cotton, wool, and other produce are carried down river to the railroad, and merchandise, fertilizers, and plantation supplies are brought back in return, and it is expected that as soon as navigation between these points is altogether safe, tri-weekly, and, in all probability, daily connection will be established. Mail, express, and freight facilities will be improved and increased. Ready markets, by steamers and railroads, for cotton, wool, timber, lumber, and other produce will be placed within easy reach. The production of staple articles, which within the past year has greatly increased, will be more than doubled. Immigration, which before the improvements had scarcely been looked for, but which within the last year has been steadily on the increase, will continue to come in, and there is no doubt but that the natural facilities for industrial and manufacturing interests will be greatly improved.

In consequence of the improvements made so far, a large extent of valuable river land and bottom, which before the improvements regularly overflowed in the spring of the year, and sometimes in August and September, has been reclaimed, and is now being successfully cultivated. A considerable extent of pine-woods land, which not more than a year ago was considered almost worthless, except for the timber on it, is now being planted with cotton, corn, &c., fertilizers being now, owing to sure transportation, cheap and within easy reach of the farmer. Saw-mills are being erected throughout the country. Turpentine stills, cotton and woolen mills, furniture, wagon, and buggy factories, and tan-yards have been established on the upper river, and by the further improvement of this river these industries will be greatly improved and increased.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, that is to say, from the mouth of the river to Holmes Creek, and from Half-Moon Bluff, Fla., to Newton, Ala., is $50,000. Of this amount $5,000 should be expended on the improvement of the bar at the mouth of the river called Cypress Top.

The obstructions on the bar at Cypress Top consist of sunken logs, snags, and trees, which are holding the sand, and it is expected that by the removal of these obstructions the bar will be deepened so as to allow boats of 5 feet draught of water to cross at all times. These improvements will greatly assist boats navigating in the lower river up to Holmes Creek.

The balance, $45,000, can be profitably expended in continuing the removal of obstructions between Half-Moon Bluff and Newton, which consist of snags, stumps, trees, gravel bars, loose rocks, and fish-traps. A number of sloughs and cut-offs should also be closed, so as to confine

the water of the river into one channel, which, by increasing the currents, would have a tendency towards scouring and deepening the main channel.

The benefit that may be expected from the expenditure of these amounts, and for the purpose stated, is the opening of the river between the railroad at Half-Moon Bluff, Fla., to Newton, Ala., to navigation, thereby securing to those living on or near that section of the river a great saving in freights, and greater convenience and safety to the rapidly increasing commerce on that part of the river already partially improved.

This river is not susceptible of a permanent and complete improvement, owing to the continual washing of the banks and shifting of the channel. Five thousand dollars would probably be required annually to preserve the improvement after completed.

Owing to the prevalence of yellow fever at Pensacola during the fall of 1882, the greater portion of cotton and other produce, which were heretofore transported down the river to Pensacola, had to be hauled to the nearest railroad station and shipped from there, Pensacola being strictly quarantined, and consequently a comparatively small amount of freights were carried up or down the river during that season. Merchants and farmers were obliged to haul their produce and supplies to and from the nearest railroad station before the improvements were commenced. As soon as steamers were placed on the river, which made comparatively quick and regular trips to Pensacola, the annual reduction and saving in railroad freights, and expenses of hauling, by river competition exceeded 100 per cent. on merchandise and fertilizers, and over 200 per cent. on cotton, wool, &c., as will be shown by the following:

In 1875 the cost of hauling and shipping from Geneva or Newton, per railroad, to New Orleans, of one bale of cotton, was $4.50; to-day, steamers, connecting, of course, with the Pensacola and Atlantic Railroad, ship cotton through for $1.75 per bale. Wool was hauled and shipped, in 1875, at $1 per 100 pounds; to-day it is shipped through for 30 cents per 100 pounds. In 1875 the freight and expenses of hauling of one barrel of flour from New Orleans to Geneva or Newton was $1.30; to-day it is 65 cents per barrel. All other freights have been reduced in proportion.

Money statement.

July 1, 1882, amount available	$428 93
Amount appropriated by act passed August 2, 1882*	20,000 00
	20,428 93
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	11,268 97
July 1, 1883, amount available	9,159 96
Amount (estimated) required for completion of existing project	66,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	50,000 00

* $2,000 of this amount allotted to La Grange Bayou.

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COMMERCIAL STATISTICS.

The aggregate amount of staple articles transported on the river during the fiscal year ending June 30, 1883, is as follows, as compared with the year 1874:

Articles.		1883.	1874.
Cotton	bales..	3,000	350
Wool	pounds..	20,000	1,500
Sirup	barrels..	300	70
Sweet potatoes	bushels..	3,000	1,000
Peanuts, pease, &c	do ..	800	150
Fowls	dozen..	500	200
Honey	gallons..	500	60
Eggs	dozen..	3,500	500
Cattle	number..	300	.....
Gophers	do....	900	100
Firewood	cords..	700	.....
Sugar	barrels..	150	.....
Hewn timber	cubic feet..	700,000	160,000
Sawn-timber	do....	650,000	.....
Saw logs	number..	375,000	35,000
Lumber	feet..	200,000	.....
Grain	bushels..	50,000	2,000
Guano	tons..	1,300	.....
Salt	sacks..	2,000	350
Iron	tons..	2,000	.....
Hay	bales..	150	.....
Machinery and agricultural implements	tons..	600	.....
Merchandise	do....	5,000	400
Turpentine	gallons..	2,000	.....
Rosin	barrels..	50	.....
Staves	number..	10,000	.....
Shingles	do....	20,000	.....

The character, number, tonnage, draught of water, &c., of the vessels or crafts employed on the river during the fiscal year ending June 30, 1883, were as follows:

Names of vessels.	Character.	Length.	Tonnage.	Draught.
		Feet.	*Tons.*	*Feet.*
Peerless	Steamer	190	276	5
Big Sunflower	do	165	210	4½
Alice	do	133	150	4½
D re	do	126	130	3
Hercules	do	90	50	5
Lulu Burns	do	31	5	3½
Dora	Schooner, sail	43	20	3½
South Ann	do	40	15	3½
Adalaide	do	38	15	3
Sarah	Sloop, sail	38	17	3½
Rhoda	do	34	13	3½
Dora	do	28	8	2½
Flying Cloud	do	27	6	3
Santa Rosa	Steamer	100	60	4
Mary Ida	do	110	68	3½
Eddie Lee	Schooner, sail	65	41	4½
Thomas Jones	do	70	40	4
C. W. Jones	do	67	41	4½
Mary Ellen	do	70	40	4½
Katie	do	65	40	4½
Advance	do	60	35	4
A. C. Monroe	do	55	28	3½
Genoa	do	50	27	4½
Idell	do	55	29	4½
Laurah	do	58	35	4½
Fannie Ann	Three-masted schooner, sail	75	56	5
South Ann	do	31	13	3½
Lady Ann	do	35	17	2½
Nellie	do	48	35	5
Katie Maria	do	65	41	5
Captain Jack	do	35	18	3½
Alexander Cooke	do	35	15	3½
American Union	do	50	35	4½
Dolphin	do	40	18	3½
Mary Mack	do	40	18	3½
Francis Marion	do	40	18	3½
Gracie Belle	do	65	41	4½
Lilly Bell	do	66	40	4½

Names of vessels.	Character.	Length.	Tonnage.	Draught.
		Feet.	*Tons.*	*Feet.*
Agnes	Three-masted schooner, sail	55	28	3½
Ellen G	Schooner, sail	70	43	4
Ella	do	40	15	3
Rinaldo	do	40	20	3
Florence	do	35	18	3
Rhoda	Sloop, sail	34	13	3½
Sarah	do	38	17	3½
Martha Crawford	Barge, poling	100	80	4
J. Gray	do	100	75	3½
McLane	do	95	80	4
Ed. Woodward	do	85	28	3½
A. D. McKinnon	do	75	20	3½
P. Cumba	do	80	50	3½
S. Halloway	do	86	60	4
Flat (no name)	Flat, poling	50	10	2
Do	do	47	10	2
Do	do	30	5	1½

Vessels employed in transportation during the year preceding commencement of improvement.

Names of vessels.	Character.	Length.	Tonnage.	Draught.
		Feet.	*Tons.*	*Feet.*
Rhoda	Sloop, sailing	34	13	3½
Grayhound	Barge, poling	75	20	3
Hinson	do	80	22	3

M 11,

IMPROVEMENT OF CAHABA RIVER, ALABAMA.

The first examination and survey of this river provided for by act of Congress approved June 23, 1874, from Centreville, Bibb County, Alabama, to where it enters the Alabama River was made during the months of August and September, 1874. The report was made during the month of January, 1875, and is contained in the Annual Report of the Chief of Engineers for 1875.

A second examination and survey provided for by act of Congress approved June 14, 1880, being a continuation of the survey of 1874, from Centreville to Shades Creek, or the north boundary of Bibb County, including a line of levels on the lower portion of the river, was made during the months of August and September, 1880, the report of which is contained in the Annual Report of the Chief of Engineers for 1881.

The Cahaba River flows through and drains parts of the following counties, viz: Saint Clair, Jefferson, Shelby, Bibb, Perry, and Dallas. It is formed at the northern boundary of Shelby County by the East and West Cahaba rivers, which take their rise in the southwestern part of Saint Clair County, flows in a southwesterly course to Centreville, Bibb County; from Centreville its direction is a little west of south for a short distance, when it takes a general southerly course, emptying into the Alabama River about 20 miles below Selma. Above Centreville the river is a series of pools and falls, having a fall of 109.2 feet in 21 miles. Below Centreville it is a series of pools and rapids, having a fall of 127.4 feet in 88 miles, which is the distance from Centreville to its mouth.

The original condition of the river from Centreville to its mouth was such that it was extremely dangerous to navigation during high water At low water the channel was so obstructed by snags, logs, sunken trees

overhanging timber, shoals, and reefs, that navigation by either steamboat or flatboat was a matter of impossibility. The river was also spanned by three bridges—two railroad and one county road bridge. The railroad bridges are still in existence; the county bridge was swept away during the high water of 1881. The railroad bridges are fixed structures, the bottom chord of each being only a few inches above the level of extreme high water. These two bridges will have to be changed to draw-bridges so as to permit the passage of boats at all stages of water, before the improvement now being carried on can be of any benefit to navigation and commerce.

The river is divided by the character of the work required for improvement into two sections; the first or Lower Cahaba River to comprise all that portion of the river from its junction with the Alabama River up to the town of Centreville, the head of navigation. The second section, or Upper Cahaba River, to comprise all that portion of the river from the town of Centreville up to Cane Creek, a distance of 21 miles.

The project adopted was designed to obtain for the first or Lower Cahaba River a navigable channel from its mouth up to the town of Centreville, with channel in open river 100 feet in width, with a least depth of 3 feet at low water, with width in soft rock and bar cuts of 60 feet, and a least depth of 3 feet.

This to be accomplished —

(1) By the removal of all snags, sunken logs, and fallen-in timber from the channel, and the removal of all overhanging trees from the banks wherever they may interfere with navigation.

(2) By cutting through the soft rock and gravel bars that now obstruct the channel at many points, a channel 60 feet wide, with a least depth of 3 feet at low water.

(3) By contracting the channel where the river has an unnatural width, and closing such chutes and cut-offs as cause shoal places in the main river.

(4) By widening the river at several points by cutting away the banks and islands which narrow it to less than the width contemplated in the plan of improvement. The estimated cost of this plan of improvement that would insure steamboat navigation from its mouth up to Centreville is $195,000.

The appropriation for the work is as follows:

By act of Congress passed August 2, 1882	$20,000

Work was commenced under this appropriation on the improvement during the month of March and prosecuted to the end of the fiscal year.

The plant formerly used on the improvement of the Noxubee River, Mississippi, was transferred to this river, and work was commenced at the bridge of the New Orleans and Selma Railroad, 8 miles above its mouth. This was done in order to avoid the back-water of the Alabama River. The log boat having been repaired, refitted, and provided with a steam capstan, work was also commenced in the month of June at the mouth of the river, and pushed forward in the direction of Centreville.

At the close of the fiscal year all overhanging timber on the banks, snags and logs in the river-bed were removed covering a distance of 1½ miles above the mouth of the river.

All overhanging timber on the banks that would interfere with navigation, stumps and logs on the banks that were liable to form drifts, were felled and cut up, between the bridge of the New Orleans and Selma Railroad and Harrell's Ferry, covering a distance of 15¼ miles in the direction of Centreville.

The following is a summary of work done during the fiscal year ending June 30, 1883:

Number of overhanging trees felled and cut up	4,601
Number of overhanging trees trimmed	371
Number of stumps on banks cut level	672
Number of logs on banks cut up (drift)	164
Number of logs and snags removed from bed of river	24
Number of miles of river worked over and partially improved	16¾
Number of miles of river remaining to be improved	71¼

As the work of improvement is not completed, the river is not as yet available for the purposes of navigation and commerce. Previous to the building of the Alabama Central Railroad Bridge (21 miles above its mouth), several steamboats went up as high as Centreville and brought out cargoes of cotton. In 1849, when the bridge was completed, navigation by steamboats ceased until 1880, when an attempt was made by a small steamer to navigate the river; she proceeded as high as Centreville, obtained a load of cotton, but on her passage down became disabled and capsized.

On completing the improvement as designed, and on the railroad bridges mentioned being changed to draw-bridges, the river will be navigable from its mouth up to Centreville, thus securing a cheaper transportation route to a majority of the farmers and planters residing in Bibb, Perry, and a portion of Dallas counties, those in Bibb and the northern portion of Perry County being practically cut off from market. With the exception of cotton, most of the products of the country are raised only to a limited extent, having no market within easy reach. The cotton crop was formerly flatboated to the Alabama River and a market, but owing to the obstructions which have grown up, accumulated, and been placed by the railroad companies, this plan has been almost entirely abandoned. Cotton now has to be hauled distances varying from 25 to 40 miles over roads that during the cotton season are sometimes impassable.

The improvement will also give a short water route from the Cahaba coal-fields to the Gulf, and would afford an easy outlet for coal, iron, building stone of excellent quality, and large quantities of timber.

The sum of $100,000 can be profitably expended during the fiscal year ending June 30, 1884, in continuing the improvement according to the project adopted.

The work is not susceptible of permanent improvement, and will require an annual appropriation of at least $5,000 to maintain the river in the condition contemplated by the plan of improvement.

The estimated value of commerce will be about as follows:

30,000 bales of cotton, at $55 per bale	$1,650,000
Cotton-seed, corn, and other products	500,000
Return merchandise and plantation supplies, say 80 per cent. of above value	1,720,000
Total	3,870,000

With the river opened for navigation and competition permanently established, the savings to the planters adjacent to the river will be at least $60,000 on their cotton crop alone annually.

With slack-water navigation above Centreville the main item of future business of the river will be the development of the immense coal, iron, and timber interests of the Cahaba Valley; its full development may possibly require an extension of the system of improvement designed for the lower river.

Money statement.

Amount appropriated by act passed August 2, 1882	$20,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	8,924 94
July 1, 1883, amount available	11,075 06
Amount (estimated) required for completion of existing project	175,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	100,000 00

M 12.

IMPROVEMENT OF TALLAPOOSA RIVER, ALABAMA.

The examination and partial survey of this river provided for by act of Congress approved June 14, 1880, from the Falls of Tallassee to its mouth, was made during the month of November, 1880, the report of which is contained in the Report of the Chief of Engineers for 1881.

The condition of the river when examined was such that at low water navigation was entirely suspended, owing to the great accumulation of logs, snags, sunken and fallen-in timber, and the large number of overhanging trees obstructing the channel, a large number of gravel and sand bars, and at some points reefs of rock crossing the river, thus rendering navigation dangerous, if not impracticable.

The river generally presents long reaches of fine open navigable water, with a width of 200 to 300 feet and a depth of 6 to 12 feet; when this width is exceeded to any extent, is found shoal water with a foundation depth of gravel and island bars.

The project adopted was designed to obtain a navigable channel from the mouth of the river to the foot of Tallassee Reefs, 2 miles below Tallassee, the head of navigation, a distance of 48 miles, with channel in open river 200 feet in width, with a least depth of 3 feet at low water; with a width in soft rock cuts of 60 feet, and a least depth of 3 feet at low water. This to be accomplished—

(1) By the removal of all snags, sunken logs, and fallen-in timber from the channel, and the removal of all overhanging timber from the banks where they may interfere with navigation.

(2) By cutting through the soft rock that now obstructs the river at several points, a channel 60 feet in width, with a least depth of 3 feet at low water.

(3) By contracting the channel at various shoal places by building dams, jetties, and dikes, and also building such shore protections as may be found necessary.

The estimated cost of this plan of improvement was $40,125.

The appropriations for the work are as follows:

By act of Congress passed August 2, 1882	$15,000

No work has been undertaken on the improvement during the fiscal year ending June 30, 1883, under the authority of the above appropriation for the reason that the river has been considerably above the low-water stage up to the close of the year, making a commencement of operations impossible.

On completing the improvement as designed, the river during the low-water season will be navigable from its mouth up to the foot of Tallassee Reefs, a distance of 48 miles, thus securing a cheaper transpor-

ation route to the section through which the river passes, now heavily taxed by the high rates of railroads.

The sum of $25,000 can be profitably expended during the fiscal year ending June 30, 1885, in continuing the improvement in accordance with the project adopted.

The work is not susceptible of permanent improvement, and it will require an annual appropriation of at least $5,000 to maintain it in the condition contemplated by the plan of improvement.

The estimated commercial products which an improved river will furnish transportation for are about as follows:

13,000 bales of cotton, at $50 per bale	$650,000
Manufactured cotton, proceeds of 6,000 bales of cotton	535,000
Timber, lumber, building-stone, and farm products	25,000
Return freights, coal, iron, and merchandise	500,000
Total	1,710,000

This may possibly be increased by the magnificent water-power furnished by the Great Falls of Tallassee and the river above, the utilization of which has commenced, and the development of which is capable of great extension.

Money statement.

Amount appropriated by act passed August 2, 1882	$15,000 00
July 1, 1883, amount available	15,000 00
Amount (estimated) required for completion of existing project	25,125 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	25,000 00

M 13.

IMPROVEMENT OF OLD TOWN CREEK, MISSISSIPPI.

The examination of this stream, provided for by the third section of river and harbor act of March 3, 1881, was made during the month of October, 1881. The report was submitted February 11, 1882, and is contained in Annual Report of Chief of Engineers, Appendix K 29, of that year.

The condition of the creek when examined showed that the obstructions consisted entirely in accumulations of fallen trees, drift and overhanging trees. There were no shoals or rapids in the stream and no artificial obstructions except a bridge 6 miles below City Point.

Old Town Creek, prior to the construction of the Mobile and Ohio Railroad, was navigated to Camargo, 16 miles from the mouth, and in 1852 or 1853 a steamer ascended to within 2 miles of City Point. It is not susceptible of improvement for low-water navigation.

Based upon this examination an appropriation of $3,000 was made by act of Congress passed August 2, 1882.

A project for prosecuting the work of improvement under this appropriation was submitted and approved. This project was designed to obtain a high-water channel for four months in the year, from December 1 to May 1, from the mouth of the creek to City Point, a distance of 30 miles, at an estimated cost of $10,000.

The object to be attained by the expenditure of this amount is the opening of a competing route for the transportation of plantation products and return supplies.

All action on the contemplated improvement was deferred by order of the Chief of Engineers until March 1, 1883.

As the amount available, $3,000, was too small to admit of any portion of it being used in the purchase of a snag-boat and equipments, it was concluded to do the work with the plant belonging to the Tombigbee River, above Columbus, (of which river Old Town Creek is a tributary.)

Continued high water in the creek, together with the fact that there was some work necessary to be done on the river, prevented the removal of the working party as proposed during this fiscal year; no work has, therefore, been attempted on Old Town Creek.

It is proposed to apply all funds that are available for expenditure during next fiscal year to the removal of all obstructions to high-water navigation, commencing at the mouth and working up-stream as far as the amount will permit in the direction of City Point.

On the completion of the improvement as projected, this stream will be navigable at high water for four months in the year, for a distance of 30 miles.

The benefits to commerce that will accrue from the accomplishment of this improvement is the opening of a water-way in competition with the Mobile and Ohio Railroad, thus affording directly a more convenient and accessible route to market, thereby materially decreasing freight charges on cotton and return supplies, as well as indirectly securing the advantages of competition. It is estimated that about 34,000 bales of cotton, now transported by rail, would naturally seek this route and that a saving of $1.50 per bale over railroad freights would follow, thus securing to the community an annual saving of $50,000, and a corresponding reduction on return supplies of probably 80 per cent. in value of the cotton.

The sum of $7,000 can be profitably expended during the fiscal year ending June 30, 1885, in completing the improvement according to adopted plan.

Money statement.

Amount appropriated by act passed August 2, 1882	$3,000 00
July 1, 1883, amount available	3,000 00
Amount (estimated) required for completion of existing project	7,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	7,000 00

M 14.

IMPROVEMENT OF LA GRANGE BAYOU FROM ITS MOUTH TO FREEPORT FLORIDA.

This bayou extends about 2 miles, in a northeasterly direction, from the north side and near the head of Choctawhatchee Bay, Florida. Into it flows Cedar Creek, a deep stream, from 90 to 160 feet wide. Freeport is situated on the creek, 1½ miles above the head of the bayou.

The commerce that would be benefited by the improvement is the transportation of cotton, wool, cattle, lumber, merchandise, &c., from and to Pensacola.

The adopted project for the improvement of this bayou was dredging a channel of 100 feet wide to a depth of 5 feet through the flats to the bayou; estimated quantity and cost of work:

66,481 cubic yards dredging, at 30 cents	$19,944 30

The condition of the channel remains about the same, as far as availability or adaptability for the purposes of navigation and commerce are concerned, as at the time of the survey.

An allotment of $2,000 having been made from the appropriation of $20,000, for Choctawhatchee River improvement, Alabama and Florida, it is proposed, as this amount is inadequate for dredging purposes, to expend it in the removal of obstructions, such as snags, logs, trees, &c., in Cedar Creek, from the head of the bayou to Freeport, Fla. No material results would be derived, however, except a clear channel through Cedar Creek.

The balance of the estimated cost of the improvement ($17,944.30) could profitably be expended in dredging during the fiscal year ending June 30, 1885.

The benefits and advantages to be expected from the improvements would be the saving of several days' detention to vessels going to and from Freeport.

The estimated amount required for the completion of this work is $19,944.30. The improvement would in all probability be permanent.

The aggregate amount of staple articles transported through this bayou during the fiscal year ending June 30, 1883, is as follows:

Cotton	bales..	600
Wool	pounds..	20,000
Cattle	number..	500
Sheep	do...	500
Saw logs	do...	30,000
Lumber	feet..	800,000
Merchandise	tons..	300

Money statement.

Amount allotted from that appropriated by act passed August 2, 1882	$2,000 00
July 1, 1883, amount available	2,000 00
Amount (estimated) required for completion of existing project	17,900 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	17,900 00

M 15.

IMPROVEMENT OF WITHLACOOCHEE RIVER, FLORIDA.

The examination of this river was made under authority of the act of Congress approved March 3, 1879, in the latter part of September, 1879.

In the months of December, 1881, and January, 1882, a snag-boat was built and equipped for the improvement of this river and Peas Creek, which began work on the improvement of this river February 22, 1882.

At this time the entrance to the mouth of the river by the southwest pass was through a narrow, tortuous channel, varying from 75 to 150 feet in width, and from 1 foot to 4.5 feet in depth at extreme low and extreme high spring tides.

From the mouth to a point about 22 miles up-stream the channel of the river had a width of about 100 feet and a least depth of 7 feet; was but slightly obstructed by timber or drift. From hence to a point estimated to be 47 miles from the mouth of the river the channel was found to be 75 feet to 100 feet in width, and badly obstructed by ledges of limestone crossing the river, on which there was at this time a least depth of 2 feet, flowing through narrow and crooked channels, and by large numbers of trees fallen in from the bank, and drifted logs and *débris* lodged against them. The condition of the river at this the low stage of the water was such that a small steamer, the Forest Flower, of 20 tons capacity and 2.5 feet draught, was compelled to discontinue

her trips above the first shoal, about 22 miles above the mouth of the river, chiefly because of the rocky shoals.

The project adopted for the improvement was the removal of the loose and detached stones from the shoals and of such overhanging trees from the bank and all logs and drift *débris* from the bed of the river as would obstruct navigation by boats of 2 feet draught during the six or seven months of high water. Thus far this project has been adhered to.

At the point last named, or about 47 miles from the mouth of the river, the work was suspended May 28, 1882, and the snag-boat taken back to Cedar Key.

On the 12th of July, 1882, a force was organized at Cedar Key, and the snag-boat started to resume work on this river. Being detained in removing the *débris* brought down by a rise of 4 feet in the river since the work was suspended, the point at which it was suspended was not reached until the 28th of July, 1882. From hence the original plan was adhered to, to the end of the proposed improvement at Hay's Ferry, which point was reached on October 27, 1882, making a distance, variously estimated, at 66.68 miles by United States land surveys, 100 miles by examining engineer's estimate, and 125 miles by local estimates, from the mouth, which had been partially improved.

With the exception of the bars at the mouth of the river, the first 20 miles of the channel, in ascending, will need no additional work for several years. The balance of the river to Hay's Ferry requires to have the passages across the rocky shoals deepened, widened, and straightened by blasting and removing the large rocks lying in and obstructing same. No careful examination having been made with that object in view, no estimate can be made of the amount of rock thus to be removed, or the probable cost of same; indeed, it will require much time and a critical examination, made at the lowest stages of water, to make any reliable estimate thereof.

Original estimate, made under the great disadvantage of extreme high water, is probably largely below the needed sum.

Independently of these rock shoals, the channel, except at Indian Ford, Morrison Shoals, upper end of Lower Cypress Reach, Graham's Shoals, and at the Three Bridges, all of which are sand shoals of considerable extent, does not need deepening to fulfill the requirements of the original project; but the width needs to be increased at the narrows between Horn's Bridge and Morrison's Landing, between Panasofkie Outlet and Juniper's Lake, between Sheel Island Lake and Bonnet Lake, between Bonnet Lake and Carter's Lake, between Carter's Lake and Graham's Lake, between Graham's Lake and Peters' Lake, and at the Three Bridges.

The whole work actually necessary, probably not exceeding 1 mile in length, to be increased from 30 feet in width to 60 feet; to accomplish which, perhaps, no dredging will be necessary after removing the trees and closing other adjacent passages.

On the 30th day of June, 1883, the river was available for navigation by boats of 2 feet draught and 20 feet beam during the high stage of the water, from the mouth to Hay's Ferry, except in such of the narrows enumerated above as may have become choked by floating grass and lettuce since the suspension of the work.

Any funds which may be available for the ensuing fiscal year could be advantageously used in improvement of the passages through the rocky shoals in the lower river, from Beef-steer Shoals to Morrison's Shoals, and in widening the narrows enumerated above.

The amount of $16,400 could be profitably expended during fiscal

year ending June 30, 1885, on this work, with the advantage of making the river navigable for a greater length of time each year, thereby furnishing facilities for getting to market the large quantities of oranges and vegetables now being raised in the adjacent country.

In consequence of the sandy soil and heavy growth of timber along the banks of the stream this improvement will not be permanent, but will require an appropriation of $2,500 per annum, applied at intervals of two or three years to the removal of the timber falling from the banks into the channel.

In consequence of the unfinished condition of the proposed improvements, together with the almost unprecedented length of time of the low-water stage, no boats have run regularly on the river, and therefore the produce of the country has been hauled in wagons to Crystal River, Ocala, Sumterville, Leesburg, and Brooksville, at which places no record of amounts of produce from this section have been kept, and it is therefore impossible to give any statistics of the amounts of corn, cotton, potatoes, oranges, and vegetables which would have been transported on the river during the past year had these improvements been completed.

Large groves of oranges have been and are still being planted along the upper portion of this river, in consequence of the proposed improvements, and relying upon the river as a means of transportation to market. Some of these groves are now bearing, the crops of which for 1882, amounting to between 5,000 and 6,000 boxes, had to be hauled from 10 to 30 miles to market.

Money statement.

July 1, 1882, amount available	$3,931 63
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,931 63
Amount (estimated) required for completion of existing project	16,400 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	16,400 00

M 16.

IMPROVEMENT OF CALOOSAHATCHEE RIVER, FLORIDA.

The examination of this river, provided for by act of Congress, approved June 18, 1878, was made during the months of March and April, 1879, and report is contained in the Report of the Chief of Engineers 1879, Appendix J, page 863.

This examination of the river, which was made along its entire length from the Gulf to Lake Okeechobee, showed that the opening of the river from its mouth to Fort Myers, the principal trading post, making the same accessible to vessels of 6 feet draught, would fully satisfy the needs of commerce for years to come. The estimated cost is about $20,000.

An appropriation of $5,000 was made by act of Congress passed August 2, 1882.

Based upon this appropriation a project was submitted and approved during this fiscal year for deepening the channel of this river from its mouth to Fort Myers, a distance of 14 miles, to a depth of 7 feet at ordinary low water, with an average width of 100 feet. The work to commence at the 7-foot curve on the outside of bar at the mouth, by dredging under contract.

Advertisements for proposals for dredging were published August 30, 1882, and opened September 30, 1882. The award of contract was recommended to Mr. S. N. Kimball, the lowest bidder, at 62½ cents per cubic yard, under date of September 30.

Action on this recommendation was deferred by the Chief of Engineers, and award was not made until March 9, 1883. Contracts were forwarded April 7 and returned approved April 12.

The specified time for commencing the work on this improvement is July 16. No operations are therefore to be reported for this fiscal year.

It is proposed to apply all funds that are available for expenditure during next fiscal year to the deepening of the channel from the mouth of the river to Fort Myers, in accordance to plan adopted.

The benefit that will most likely accrue from the completion of this improvement is the rendering of the river navigable from its mouth to Fort Myers, a distance of 14 miles, for vessels drawing 6 feet of water, thereby increasing the facilities for trade between points on the river.

No reliable information could be obtained as to amount of trade along the river during the fiscal year.

Money statement.

Amount appropriated by act passsd August 2, 1882	$5,000 0
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3 59
July 1, 1883, amount available	4,996 41
Amount (estimated) required for completion of existing project	15,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	15,000 00

Abstract of bids received and opened September 30, 1882, for dredging at Caloosahatchee River, Florida.

No.	Names of bidders.	Price.	Date of commencement.	Date of completion.
		Per cu. yd.		
1	S. N. Kimball	$0 62½	In accordance with specifications.	In accordance with specifications.
2	John Maguire	64½	....do	Do.

M 17.

IMPROVEMENT OF PEAS CREEK, FLORIDA.

The examination of this creek was made under authority of act of Congress approved March 3, 1879, in the month of November following.

In consequence of the same snag-boat having to be used both on this creek and the Withlacoochee River, and the work on the latter having been begun first, the improvement of this stream was deferred until after the suspension of the work on the Withlacoochee River, November 24, 1882.

The necessary preparation for a tow at sea, and the arrangements for chartering a tow-boat to take the snag-boat from Cedar Keys to Peas Creek, delayed the departure from Cedar Keys until February 12, 1883. Seven days were consumed in making the trip to Fort Winder, on Peas

Creek, about 15 miles above the mouth, and on the 19th of February the work of removing the obstructions from the channel was begun.

The project adopted for the improvement was that recommended by the examining engineer: "The removal of overhanging trees and limbs that would obstruct passing vessels," and of "all masses of rock, snags, and accumulation of logs from the channel," so that the river may "be constantly navigated by vessels of 14 to 24 inches draught during the six months following the beginning of the rainy season."

The river was found to be at a very low stage, the rainfall of the preceding season having been the least known for years, but the tides raise the water from 6 to 15 inches as high as Dishong's Ferry.

Up to Johnson's Ferry, about 25 miles above Hickory Bluff, the river was found to be amply sufficient in width and depth to fulfill the requirements of the projected improvement, and but slightly obstructed by fallen trees and drifts; from hence to within one-half a mile of Dishong's Ferry, a distance of about 5½ miles, the river is excessively crooked, flowing through quicksand beds bordered with huge branching live-oaks. Hundreds of these trees have been undermined and tumbled into the stream, so changing the bed of the river as to bring these trees, roots, branches and all into the middle of the channel. Around these as nuclei have accumulated quantities of floating brush and *débris*, which in time have been covered over by, and imbedded in, the drifting quicksands to such an extent as to make it very laborious and tedious to break them out. Nearly an entire day is sometimes consumed in raising and disposing of one of these live-oaks and the accumulated drifts upon it. Hence the progress since passing Johnson's Ferry has been discouragingly slow. About one-eighth of a mile more of this kind of work remains in advance of the boat, after passing which the very worst portion of the work will be done. No reason has yet been developed to make an alteration in the original project advisable.

About 36 miles of river has been cleared of overhanging trees and limbs, and of all snags and accumulations of logs; there are no rocks in this portion of the river.

The least depth found on the sand shoals at low tide is 1 foot. This, there is reason to believe, will be improved upon by the washing away of the shoals, which are quicksand, during the next rise in the river, where the removal of the obstructions have given free play to the current. About 125 miles of river remain to be improved in the same manner.

The condition of the river at this time in consequence of the incompleteness of the work and of the extreme low stage of the water, caused by an unusually long period of dry weather, is not such as would permit boats of 2-foot draught to ascend the river more than 20 miles above Hickory Bluff.

The funds available during the fiscal year ending June 30, 1884, it is proposed to use in extending the present project of improvement in the direction of Fort Meade.

It is estimated that $5,700 can be profitably expended in the furtherance of this plan during the fiscal year ending June 30, 1884.

The work is not yet sufficiently advanced to make an estimate as to whether there will be needed an additional sum to complete the present project, but it is not thought that the improvement will be permanent.

About $2,500 per annum it is believed will be necessary to clear the stream of drifts and "washouts" after each season of high water, in order to maintain the condition contemplated in the proposed project.

From the irregular and desultory character of the transportation, and from the fact that no reliable record is kept of the commerce of the river, which is entirely coastwise, the larger portion of it being transported overland in wagons, by way of Tampa and Manatee, no authentic statement of same can be given.

Money statement.

July 1, 1882, amount available	$4,576 67
Amount appropriated by act passed August 2, 1882	4,000 00
	8,576 67
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4,512 84
July 1, 1883, amount available	4,063 83
Amount (estimated) required for completion of existing project	5,700 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	5,700 00

M 18.

IMPROVEMENT OF ESCAMBIA RIVER, FLORIDA AND ALABAMA.

An examination and partial survey of this river was made in 1878 and 1879, from the Alabama and Florida State line to its mouth.

The river was ascertained to be from 150 to 300 feet in width and with ample depth for steamboat navigation. The obstructions were found to consist of a bar at its mouth, snags and overhanging trees along its course.

The plan adopted for its improvement was to dredge a channel through the bar, remove the overhanging trees and snags, and construct such dams and protections of the banks as were required to conserve the water to the channel of the river.

The work of dredging a channel 100 feet wide and 5½ feet deep through the bar at the entrance of the river was performed under contract during the last fiscal year.

No work has been done upon this improvement during the fiscal year ending June 30, 1883, beyond the construction of a log-boat intended to be used conjointly upon this and the Conecuh River in Alabama.

The improvement remains in good condition, no perceptible shoaling having occurred in the cut since its completion. Its adaptability to the navigation of the river and facility for the towage of lumber rafts, previously dependent upon the tides, for movement from Ferry Pass to the head of the bay, constitute its chief advantage.

It is proposed that the funds available for expenditure during the fiscal year ending June 30, 1884, be applied to the employment of the log-boat and party in removing snags and overhanging timber, and to the construction of dams and shore protections for conserving the water to the channel.

The results that may be expected from such application will be an improved condition of the channel in the river by the removal of obstructions.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, will be $6,000, to be applied to the removal of snags and overhanging timber and in constructing shore protections with the consequent advantages to navigation.

The estimated amount, exclusive of appropriations, already made, required for the completion of the improvement is $6,000, after which it will require an annual appropriation of $3,000 to keep it clear of obstructions and maintain it in the condition contemplated in the plan of improvement.

Money statement.

July 1, 1882, amount available	$3,360 43
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,360 43
Amount (estimated) required for completion of existing project	6,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	6,000 00

M 19.

IMPROVEMENT OF ESCAMBIA AND CONECUH RIVERS, FLORIDA AND ALABAMA.

An examination and partial survey of the Conecuh River was made in 1878, from the vicinity of Troy, Ala., to its confluence with the Escambia River, near the Florida line. The river was found to be capable of being rendered navigable for steamboats drawing 30 inches, to a point estimated about 5 miles above Gantt's Shoals, and for flat-boats to Indian Creek, about 10 miles south of Troy, Ala. The obstructions consist of fallen, overhanging, and drift timber, with rock shoals in the upper part of the river.

The plan of improvement recommended was the removal of the timber obstructions, and overcoming the shoals by the construction of wing-dams or locks, as might be required, closing cut-offs with dikes, and protecting the banks, wherever necessary, to conserve the water to the channel.

The work of improvement was begun by the construction of a log-boat, to be used conjointly upon this and the Escambia River, which was employed from October 22, 1882, to January 17, 1883, in removing snags and overhanging trees from that part of the river continguous to and above the town of Brewton, Ala. The distance wholly cleared of obstructions was about 4 miles, embracing that portion of the lower river where the obstructions were the most numerous. The work was then suspended on account of high water.

The number and character of obstructions removed were as follows:

Obstructions.	October.	November.	December.	January.	Total.
Fallen trees	35	95	53	31	214
Snags	28	183	162	143	516
Dead-head logs	3	19	23	4	49
Hurricane stumps	5	82	61	37	185
Overhanging trees	10	47	60	135	252
Total number of all kinds	.....	.....	.....	.....	1,216

The entire distance included in the original estimate for this work from the Florida line to Indian Creek is 193 miles. It is, however, proposed, in order to afford immediate relief to the commerce of that part of the river below Andalusia, to confine the work to those portions of the Escambia and Conecuh rivers as is best calculated to insure this

relief, and which will embrace parts of the following divisions upon the Lower Conecuh River:

	Miles.
From Florida line to Healy's Ferry	19½
From Healy's Ferry to Coal Bluff	7
From Coal Bluff to Parker's Ferry	10
From Parker's Ferry to Sepulga River	20½
From Sepulga River to Andalusia	30
Total distance	87

And also parts of the river from the head of Gantt's Shoals to Smiley's Bridge, a total distance of about 75 miles, on the upper river.

The work of improvement has not yet advanced sufficiently to add materially to its availibility for the purposes of navigation and commerce.

It is proposed that the funds available for expenditure during the fiscal year ending June 30, 1884, be applied to the further improvement of the river in manner contemplated in the project, with the view of affording the desired relief to commerce, by extending the period of its movement to the lower stages of water.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $25,000, to be applied to the removal of obstructions from Smiley's Bridge to the head of Gantt's Shoals, a distance of about 75 miles, and to the continuation of the proposed work from Andalusia to the Florida line. The advantage to be derived from such expenditure will be that of affording a desirable relief to the commerce of that part of the river above the shoals, tending to increase it largely, and in a like manner to facilitate the movement of that of the lower river.

The estimated amount, exclusive of appropriations heretofore made, that will be required for the entire completion of the work is $50,430, according to the project.

An anuual appropriation of $3,000 will probably be required to remove obstructions occasioned by drift timber.

Money statement.

Amount appropriated by act passed August 2, 1882	$12,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	3,377 94
July 1, 1883, amount available	8,622 06
Amount (estimated) required for completion of existing project	50,430 00
Amount that can be profitably expended in fiscal year ending June 30, 1885.	25,000 00

M 20.

IMPROVEMENT OF ALABAMA RIVER, ALABAMA.

The examination and partial survey of this river was made during the months of July to October, 1875, as provided for by act of Congress approved March 3, 1875. The report was made during the month of March, 1876, and is contained in Annual Report of the Chief of Engineers, United States Army, for 1876.

The original condition of the river channel during the low-water season was such that commerce was much restricted, the smallest class of

steamboats only running. These restrictions were caused by the innumerable bars, shoals, reefs, and collection of sunken logs, at many of which points the low-water depth was reduced to 3½ feet, and at some points to 2½ feet.

The general width of the river from the mouth of the Tallapoosa River down to Gainstown ranges from 500 to 600 feet; below that point the width increases to 700 and 800 feet. Wherever these widths are exceeded to any extent are found the bars, shoals, and reefs. In the open reaches ample water is found.

The project adopted was designed to obtain a channel depth of 4 feet at low water, with a minimum width of 200 feet from the mouth of the river, 50 miles above Mobile, Ala., to the city of Wetumpka, Ala. The estimated cost was $229,741.

The appropriations for the work are as follows:

By act of Congress approved June 18, 1878	$25,000
By act of Congress approved March 3, 1879	30,000
By act of Congress approved June 14, 1880	25,000
By act of Congress approved March 3, 1881	20,000
By act of Congress passed August 2, 1882	20,000
Total	120,000

Work was commenced on the improvement during the low-water season of 1878, and prosecuted through the fiscal years ending June 30, 1879, 1880, 1881, and 1882.

During the present fiscal year nearly all the bars and shoals from the mouth of the river up to the city of Montgomery have been worked on to a greater or less extent, the most dangerous logs and snags removed from the channel, and nearly all the island chutes and close places cleared of overhanging timber. At the "Cut-off," 70 miles above Mobile, a break was found in the dam constructed at that point some two years since; efforts were made to close it by sinking the hulk of the old snag-boat and laying mattresses in the breach, but the work was undertaken too late in the season. The river rapidly forced a suspension of this work until some more favorable opportunity.

The following is a summary of the work accomplished during the fiscal year ending June 30, 1883:

Miles from Mobile.	Names of places.	Piles driven.	Mattress sunk.	Bank protection.	Snags and logs removed	Overhanging trees cut.
			Linear feet.	*Linear feet.*		
70	Cut-off	12	80	200	1	
90	Mouth Little River				1	
101	Matheuson's Bar				11	
106	Choctaw Bend				2	
108	Williamson's Bar				1	
109	Mount Pleasant				1	
119	Carter's Bar				5	
122	Jewitt's Bar				28	22
126	Flynn's Bar				83	
154	Silver Creek Bar				105	
180	Stun's Island				48	260
183	Lower Peach Tree				1	19
184	Ohio Bar				1	
185	Montgomery Bar				41	18
192	McNeil's Bar					19
195	Pursley Creek Bar				2	
197	Tate's Island				38	47
203	Hobb's Island				51	12
206	Harris' Evans Bar				46	204
208	Walnut Bluff				24	
209	Beaver Creek				53	
228	Cobb's Creek				29	
229	Foot Mixon's Chute				3	89
241	Petaway's Chute				32	29

Miles from Mobile.	Names of places.	Piles driven.	Mattress sunk.	Bank protection.	Snags and logs removed.	Overhanging trees cut.
			Linear feet.	*Linear feet.*		
254	Day's Wood Yard				3	
259	Mouth White Oak Creek				23	
260	Portland Lower Bar				1	
268	Keyser's Creek				27	
270	Portland Upper Bar				90	30
273[2]	Lower Sister Bar				11	
274[2]	Middle Sister Bar				66	2
275	Upper Sister Bar				1	
276	Mollett's Landing				8	
278	Rifleman's Bar					70
282	Mary Taylor's Bar				29	17
285	King's Bar				44	48
287	J. E. Mathew's Landing				4	
289	Cahaba				7	
300	King's Bend				27	28
309	Chute above Selma				86	268
310	Kornegay's				42	111
316	Fish Trap Bar				131	85
324	Mrs. Bat Smith's				47	56
324[2]	Chute below Gardner's Island					3
325	Gardner's Island				135	188
326	Gaston's Bar				1	
378	Tallawassee Creek				47	
379	Chute below Manack's				36	115
380	Manack's Island				10	
381	Opossum Bight				45	9
383	Catoma Creek				55	738
384	Hadnot's Bar				1	257
	Total	12	80	200	1,584	2,744

The following table shows the character and extent of work done at different points on the river during previous years:

Brush dams built	linear feet	4,222
Brush jetties built	do	130
Rock dams built	do	3,061
Rock placed in dams	tons	685
Gravel put on dams	cubic yards	1,050
Cribs sunk	number	11
Clay put in cribs	cubic yards	300
Mattresses laid	number	42
Do	cubic yards	1,460
Piles driven	number	1,403
Shore end of dam built	feet	200
Snags and logs removed	number	3,209
Overhanging trees cut	do	2,150

The river from Montgomery to its mouth is available during the low-water season for all the purposes of navigation, and commerce is carried on during that period, the work undertaken and accomplished between those points affording the requisite relief. Boats are enabled to run by day or night without detention if handled carefully, the channel ways through the bars, shoals, and reefs showing a marked increase in depth and width wherever any work has been performed.

Above Montgomery navigation of the river is virtually closed during the low-water season, as no work has as yet been undertaken on that portion of the river.

It is proposed to apply the funds available for expenditure during the next fiscal year to still further improving the bars, shoals, and reefs on that part of the river from Montgomery to its mouth, and if necessary up to Wetumpka, the head of navigation; also to perfecting the works already established on the lower part of the river.

The sum of $50,000 can be profitably expended during the fiscal year

ending June 30, 1885, in continuing and perfecting the work of improvement according to the project adopted.

The work is not susceptible of permanent improvement, owing to the immense freshets which annually occur. These freshets are constantly changing the channel ways, in some instances to a marked extent.

An annual appropriation of at least $10,000 will be necessary to maintain the river in the condition contemplated in the plan of improvement.

Money statement.

July 1, 1882, amount available	$6,098 47
Amount appropriated by act passed August 2, 1882	20,000 00
	26,098 47
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	15,491 08
July 1, 1883, amount available	10,607 39
Amount (estimated) for completion of existing project	109,741 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	50,000 00

COMMERCIAL STATISTICS.

The following table will show the amount of commerce using the river during the fiscal year ending June 30, 1883:

Articles.	Quantity.	Valuation.	Amount.
Bacon ..... boxes	18,889	$40 00	$755,560
Corn ..... sacks	55,304	3 00	165,912
Oats ..... do	29,040	3 50	101,640
Hay ..... bales	8,240	3 00	24,720
Coffee ..... sacks	9,118	17 50	159,565
Bagging ..... rolls	26,260	6 00	157,560
Ties ..... bundles	48,235	1 75	84,411
Staves ..... pieces	40,000	per M, 100 00	4,000
Wool ..... bags	3,310	60 00	198,600
Hides ..... pieces	3,760	3 00	11,280
Lumber ..... M	640,000	10 00	6,400
Shingles ..... M	1,870,000	2 00	3,740
Stock ..... head	4,355	20 00	87,100
Furniture ..... packages	10,520	10 00	105,200
Cotton-seed ..... bags	56,200	60	33,720
Cotton ..... bales	47,052	55 00	2,587,860
Barrels (assorted) ..... barrels	64,220	7 00	449,540
Iron ..... tons	1,200	30 00	36,000
Miscellaneous freight ..... packages	37,910	5 00	189,550
Machinery ..... pieces	2,170	25 00	54,250
Agricultural implements ..... packages	3,490	5 00	17,450
Total	.....	.....	5,234,058

M 21.

IMPROVEMENT OF WARRIOR AND TOMBIGBEE RIVERS, ALABAMA AND MISSISSIPPI.

I.—BLACK WARRIOR RIVER.

The length of this river from its junction with the Tombigbee, near Demopolis, to Tuscaloosa, the present head of navigation, is by steamboat measurement, 140 miles. Its width between banks ranges from 300 feet at Tuscaloosa to 140 feet at its mouth. Its low-water depth, except

on the bars, is from 6 to 15 feet. Before improvement it was not navigable on less than a 4-foot stage (above low water), and was closed for a period of four to seven months annually.

The obstructions to navigation were as follows:

Ninety bars, having an aggregate length of 14 miles, with a ruling depth of 12 to 30 inches.

Many thousand snags and sunken logs, mainly in the bar-chutes, but scattered along the reaches also.

Banks fringed with overhanging trees that were troublesome at all stages of water, often carrying away chimneys and damaging the upper works of steamboats.

The improvement was authorized by act of March 3, 1875, and commenced in July following.

The general plan of improvement was to secure an unobstructed low-water channel of 80 feet in width by 4 feet depth. Work was commenced at Tuscaloosa and carried on down the river during the low-water season of 1875–'76, covering a distance of 65 miles, and partially improving that portion of the river, both by the removal of the logs and deepening of the shoalest bars. In 1877, owing to the small amount of funds available, a log-boat only was employed, which passed over the remainder of the river, but in consequence of the exceptionally high stage of water prevailing throughout the year, the low-water log obstructions were but partially removed. No bar improvement was attempted. In 1878, after two months' work, the force and equipment were transferred to the Tombigbee, and nothing more done upon the Warrior until October, 1880. Work has since been continued without interruption, except from high water. During 1881 work was carried on upon the lower portion of the river, and from the mouth to Millwood, 32 miles, all the bars affording less than 3 feet were improved, and the logs thoroughly removed as far as Lake Bend, 26 miles above the mouth. In August the equipment was increased by a barge and quarter-boat, built at Tuscaloosa, which, dropping down the river, revised the work done in 1875–'76, reaching Buzzard's Bar, 42 miles below Tuscaloosa.

In the spring of 1882 the log-boat was towed up to Williford's, 93 miles from Demopolis, to remove the trees thrown into the river by a cut-off that had formed during the winter, and in May the quarter-boats and barges were taken to Jenning's Ferry, 60 miles. At these points the boats were engaged at the time of rendering the last annual report.

Progress of the work during fiscal year ending June 30, 1883:

The bar at Jenning's Ferry was one of the worst on the river, giving at low water a depth of only 12 to 14 inches. The river here makes an elbow, and the point had cut away until the width between banks at the bend had amounted to 700 feet, while the normal width above and below is about 150 feet. The width had increased 250 feet since the survey of the river in 1874. To make a permanent improvement here, it was evident that the point must be held against further encroachment. Accordingly, much of the work done was expended in sloping the bank and extending the jetties (built of rock and brush, and confining the low-water channel within 125 feet limits) to the top of the bank about 35 feet high. Examination after the winter floods showed that this protection was effective for the lower portion of the slope, but towards the top the bank between the jetties continued to yield. When this tendency was observed, rows of water-stakes were placed between and parallel to the jetties, the effect being to check the force of the current

and induce a deposit instead of a scour. Extensive plantings of willow, maple, and gum were also made on the slope, in order to re-establish, if possible, the natural and permanent protection to the banks. Those plantings are at this time growing well, and if they survive the next winter, will form an efficient protection.

From Jenning's Ferry the force was moved to Hickman's Bar, 72½ miles from Demopolis. This bar had been improved in 1878. It was of the same type as that at Jenning's Ferry, and after improvement the point bank cut away, leaving the jetties disconnected with the shore. The work done here was to reconnect the jetties with the bank and to extend them to its top. The bank was also sloped and protected with brush-work and willow plantings.

At Log Shoals, 2 miles above Hickman's, the jetties built of brush and gravel, in 1876, were found to have worn off or settled until they barely protruded above low water. These were covered with rock, raising them 1½ to 2 feet, and two slight breaks repaired.

An experiment was tried here of building a submerged dam, with its crest 4 feet below the low-water surface and with an opening of 90 feet. The river at the time was at a 0.5-foot stage, with a depth on the dam site of 6½ feet. The effect was visible in a distinct roll over the dam and the increased head found to be 1½ inches. The discharge was not gauged, circumstances preventing, but the experiment was of value as indicating that the 80 by 4 foot channel, contemplated in the improvement of this river, can be maintained on the bars without lowering the reaches above.

Above Log Shoals caving banks were found to have injured the works at Calvin's Island, Mary H. Bar, and Alligator's. These were repaired and added to, and bank protection made similar to those at Hickman's and Jenning's.

The results thus far have been satisfactory, but the effects of but one brief freshet only have been observed, and a complete test requires the action of the winter floods.

The log-boat, after finishing at Williford's, had gone up the river 18 miles, and on the 1st of July had worked down to Buzzard's, 98 miles from Demopolis, being engaged in removing the log deposits of recent years. As the river above Hickman's had been thoroughly cleared of snags and sunken logs in 1875–'76, it was thought that this work would be light and quickly executed. The entire season, however, was spent in working between Buzzard's and Hickman's, a distance of 26 miles. This shows the effects of land-slides and caving banks, and indicates that to secure a good degree of permanency to the improvement a considerable amount of bank protection, not contemplated in the original project, must be undertaken.

The equipment of this river during the year consisted of a log-boat 70 by 24, worked and propelled by hand-power; two quarter-boats; two barges, 45 by 16 feet; and an open scow, unserviceable through age. In May, while moving down the river, one of the quarter-boats was swung by the wind against a stump, and her gunwales being very much decayed she was stove in and sunk. Everything of value was saved, and the boat not being worth repairing no effort was made to raise it.

A force of sixty-five laborers was employed until the middle of August, when it was reduced to forty on account of the small appropriation for the year 1882–'83. Work was suspended December 8 for the winter, and resumed in March, but with the log-boat only, owing to the small amount of funds unexpended.

SUMMARY OF THE YEAR'S WORK.

Time spent on the work	months..	8½
Number of bars worked on		6
Linear feet of jetties built		6,121
Linear feet of old jetties raised and repaired		1,848
Linear feet of wattled-brush fencing		3,067
Length of bank sloped and planted	feet..	3,200
Overhanging trees cut		1,013
Logs removed		1,594
Length of river worked over by log-boat	miles..	26

A line of levels has also been commenced from Tuscaloosa to Demopolis. It has at this time reached Jenning's Ferry, showing a fall of 26½ feet in 80 miles.

The total amount of work done upon this river is itemized as follows:

Number of months at work		38½
Number of bars worked on		49
Linear feet of dams and jetties built		31,080
Linear feet of brush fencing		3,067
Length of bank sloped and planted	feet..	3,200
Overhanging trees cut		[illegible],138
Number of snags and sunken logs removed		6,384

The original length of channel requiring improvement amounted to 14 miles; of this there have been improved 9.36 miles. There remain to be improved 4.64 miles. Of the portion improved additional work needed on 0.62 mile.

The log-work has been thoroughly performed on 94 miles. The remaining 46 miles have been partially cleared and can probably be finished by ten months' work of the log-boat, two months of which will be provided for by the funds yet unexpended.

The improved bars include all those that originally afforded a less depth than 2½ feet. This is now the ruling low-water depth throughout the river, and navigation is therefore open to light-draught boats in all stages. This was demonstrated for the first time during this year. The Ella D., a small boat, drawing 2 feet light and 4 feet loaded, commenced making regular trips between Tuscaloosa and Demopolis in October last, on the lowest stage of water, and has continued running without interruption up to this time.

The present condition of the improvement is as follows: The ruling depth, formerly 12 inches, has been increased to 30 inches, and the facility and safety of navigation have been greatly increased by the removal of snags and overhanging timber. Many of these obstructions, however, still remain, mainly between Lake Bend and Eree, and in low water are troublesome. On the improved bars the depth obtained is from 3½ to 4 feet, except in three cases, where rock bottom for short distances will require blasting. The width obtained for a 4-foot depth ranges from 35 to 60 feet, sufficient for the boats now navigating this river, but not enough for towing barges. A section of the channel, in the bar-chutes, generally shows a triangle with the apex next the bank, giving soundings of 7 to 10 feet, and shoaling rapidly towards the bar. To get the 80-foot channel proposed in the plan of improvement, this apex should be filled in, at intervals, to 4 feet by submerged dams or sills, the effect of which would be to force the current towards the bar and widen the channel. The soft limestone bluffs of the river, which are easily quarried with picks, will afford a cheap material for this work, but for its transportation the equipage will have to be re-enforced with steam-power.

There remain forty-one bars to improve, nine of which have soft rock

bottoms, and will require excavation by blasting to the amount of 3,000 cubic yards.

Experience has shown that to insure a reasonable degree of permanence to the improvement, caving banks in many places require protection. Otherwise, judging from data obtained on 40 miles of the river in six years' time, 700 logs will have to be removed annually to keep the river clear. The aggregate length of bank protection needed is estimated at 4 miles, and its cost $2,500 per mile. This work was not originally contemplated or estimated for.

The small balance of funds available for expenditure during the fiscal year ending June 30, 1884, will be used in keeping the log-boat at work between Lassiter's, 26½ miles from Demopolis, and Hine's Landing, 35½ miles. This portion of the river is now more obstructed by logs than any other, and it is hoped to clear it before the funds are exhausted.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is $48,000. Of this amount $15,000 is estimated to be used in building a steamboat needed for towing the other boats, for snagging, and for transporting material. With the remainder it is proposed to complete the snagging, protect caving banks, where necessary for the permanence of the improvement, and to continue the improvement of the bars, especially where blasting will be required. The results expected are the increase of the ruling depth from 2½ to 3 feet, and greater ease and safety in navigating the river, so that towing coal-barges might be undertaken.

Annual revision will be needed after the completion of the improvement. One steamboat, at a yearly cost of $10,000 for repairs and working expenses will be able to examine and maintain the improvements on both the Warrior and Tombigbee rivers.

During the past year the business of the river has been done mainly by the boats R. E. Lee and the Dove. The former has a capacity of 1,200 bales cotton on a draught of 7 feet, and the latter is a 600-bale boat, drawing 5 feet loaded. These boats have taken 15,000 bales of cotton to Mobile and brought back return freights, chiefly of bagging, ties, groceries, and plantation supplies generally. Since October, the Ella D., a small boat drawing 4 feet loaded, has been plying regularly between Tuscaloosa and Demopolis, the improvements made upon the river enabling her to run at all stages of water. The business done by the *Ella D.* is local and almost entirely of new growth.

The advantages expected from this improvement after its completion are:

I. The reduction of freight rates due to the competition between river and rail, amounting, as estimated in former reports, to be not less than $50,000 annually.

II. Doing away with the uncertainty and irregularity heretofore attendant upon river transportation, thus including increased business.

III. The utilization of the river as a channel for coal transportation to the Gulf. Coal is now taken to Mobile by rail at a charge of $2 per ton, and delivered to steamers at $4 per ton. At this price the consumption of Alabama coal has increased in Mobile from 3,015 tons in 1878 to 22,235 in 1882. River transportation would reduce the cost at least $1 per ton, and the coal business would soon become of very considerable importance.

The business on this river was done mainly by the steamer R. E. Lee, of 350 tons burden. The *Dove* made a few trips in the lower part of the river, and the *Ella D.* made twenty-seven trips between Tuscaloosa and Demopolis. The latter was a small boat, about 75 by 20 feet, and

was tried as an experiment in low-water navigation. Her business, of course, was light, the main items being 517 bales cotton, 17,105 sacks cotton-seed, and 343 bales of hay, which were taken to Tuscaloosa and Demopolis, and from these points dry goods, groceries, and hardware were carried to the river plantations, to the great convenince of the farmers.

The total business on the river during the past year, as nearly as could be ascertained, was as follows:

Articles.		Quantity.	Value.
Cotton	bales	14,058	$773,190
Bagging	pieces	507	3,042
Ties	bundles	1,311	2,294
Corn	sacks	795	1,590
Oats	do	345	690
Flour	barrels	1,166	8,162
Bacon	boxes	125	6,250
Molasses	barrels	160	4,800
Sugar	do	205	5,125
Whisky	do	85	5,100
Meal	sacks	169	253
Salt	do	1,872	2,059
Shingles	M	30	105
Lumber	do	12	180
Cotton-seed	sacks	23,600	17,700
Fertilizers	tons	100	4,000
Coffee	sacks	175	2,625
Hay	bales	393	1,759
Other packages	packages	2,959	15,000
Passengers	number	850	.....
Total value		.....	853,924

The above statement is incomplete, the value of the business done probably exceeding $1,000,000. A comparison of the cotton transported shows 14,058 bales last year, as against 9,520 bales the year preceding.

II.—TOMBIGBEE RIVER BELOW COLUMBUS.

The first improvement of this river was undertaken by the State of Alabama some forty years ago. A 40-foot channel was cut through the rock shoals at McGrew's, and wing-dams built at Truner's and Pearson's. Nothing more was done until under act of Congress of June 10, 1872, appropriating $10,000. Work was commenced with a view to improving a few bars, but after taking out two hundred and fifty snags, at a cost, including outfit, of about $5,000, the balance of the appropriation was transferred to Major McFarland, United States Engineers, to be used above Columbus.

In September, 1878, work was resumed under appropriations for the improvement of the Warrior and Tombigbee, and has been continued under subsequent appropriations, except during the high-water seasons, up to the present time. The scheme of improvement was to open an unobstructed channel of navigable width and 4 feet deep to Demopolis, and of not less than 3 feet deep from there to Columbus.

The condition of the river when the improvement was undertaken was as follows:

From the junction of the Tombigbee and Alabama (head of Mobile River) to Bladon Springs, 93 miles, navigation was practicable throughout the year. There were four bars, however, impassable at low tide (on a low river), as they then afforded a depth of only 2 feet. Moreover, some of the log obstructions could be passed only in daylight.

From Bladon to Demopolis, 100 miles above, low-water navigation

was difficult both from the bars over which the boats had to be pulled, and from the snags and sunken logs. Sometimes only 18 inches could be found on the bars, and then the boats turned back at Bladon. From Demopolis to Columbus, 416 miles from Mobile, there were numerous bars, showing 12 to 18 inches depth, and the channel was greatly choked with logs. Navigation was carried on only in the winter and spring, the high-water season, and ceased when the river reached a stage 4 to 6 feet above low water. As the usual width of the river did not exceed 150 feet, the overhanging timber was troublesome, often carrying away chimneys and damaging the upper works of steamboats. The railroad bridge at Jones' Bluff was also a serious obstacle, a strong cross-current, caused by a projecting rock point, making the descending passage through the draw difficult and unsafe.

The improvement was commenced below Demopolis, and by June 30, 1879, 130 miles of the river had been partially cleared of logs, and the five most troublesome bars improved. During the next year ending June 30, 1880, thirteen bars were improved, extending low-water navigation to a point 20 miles above Demopolis. The improvement of Ten-Mile Shoals, 13 miles below Columbus, was also commenced and continued throughout the following year. During 1881, the improvement was completed from Columbus to Nashville, 25 miles, and partially extended to Fairfield, 30 miles farther.

During the year, also, a steamboat that had been bought for the Tombigbee was fitted up as a snag-boat and worked mainly below Demopolis, removing logs and improving Rainwater Bar and Turner's Shoals. In the spring of 1882 the removal of the rock point above Jones's Bluff Bridge was commenced and continued until the river became low enough for snagging; work was then resumed above Vienna, and continued until the end of June, at which time the funds available for that portion of the river became exhausted.

The log-boat and quarter-boat having become unserviceable during the previous season, the equipment for this river was reduced to the steam snag-boat *Big B*, and a barge 40 by 16 by 3 feet. No addition to the equipment has been made during the year. The appropriation for the year ending June 30, 1883, became available too late for building boats in time for the fall season, and when it appeared that no additional funds would be provided for the year ending June 30, 1884, it was thought best to use the funds on hand in keeping the *Big B* at work, as they would even then be exhausted during the season. The *Big B*, however, was docked during the winter and her hull thoroughly repaired.

On the 1st of July the *Big B* and barge were engaged 20 miles above Demopolis in taking out sunken logs and cutting overhanging timber. This class of work was best adapted to the nature of the equipment and to the small force employed. It was also an essential preliminary to bar improvement, and it was proposed to keep the *Big B* engaged upon it throughout the season. After thoroughly clearing the river, however, as far as Belfast Chute, 42 miles above Demopolis, and taking out a steamboat wreck at that place, the steamboats which had been running as high as Vienna reported Holt's Bar, 27 miles below, impassable, with the river 2½ feet above low water, and the improvement of that bar was represented as a case of urgency. It was accordingly undertaken on the 20th of September. A survey made upon a 20-inch stage gave soundings, which, reduced to low water, showed only 10 inches on the bar crest. By removing the logs and building 1,000 feet of jetties this depth was increased to 2½ feet. After spending a month on this work the *Big B* was sent to Bassett's Creek, 108 miles from Mobile. The river here for a distance of 8 miles was formerly difficult and even

dangerous from logs, so that night running was seldom attempted. A channel was opened through the logs in 1878–'79, but from caving banks and a shifting river log obstructions had again become troubiesome. Work was prosecuted on this part of the river until December 20, when it was suspended in consequence of high water, and the *Big B* sent to Mobile for repairs. One hundred and seventy-nine logs were taken out, and, so far as could be ascertained after careful search, none were left within 7 feet of the low-water surface. In February the *Big B* resumed work at Jones' Bluff, blasting the rock point above the bridge and using the material in dikes for straightening the current through the single draw opening that is available for navigation. By removing the point it is also designed to make the draw opening passable during the high stage prevailing throughout the winter, since being next the bluff it is more suitable for night running and in windy weather. After accomplishing the first object by the middle of April, the *Big B* was sent above Vienna to complete the clearing of the channel between that point and Nashville, a work partially executed during the preceding year. At this time the river has been thoroughly cleared for 20 miles above Vienna, and it is expected to finish this work during the present season.

The items of work done in the past year are as follows:

Logs taken out	1,240
Trees cut	4,041
Cubic yards rock blasted	1,900
Feet of jetties built	1,020
Steamboat wreck removed	1

The total work done since the improvement was commenced is comprised in the following items:

Linear feet of dams and jetties	25,790
Logs taken out	5,789
Trees cut	10,684
Cubic yards of rock excavated	3,000
Steamboat wrecks removed	2

The log obstructions have been thoroughly removed from continuous stretches of the river—

	Miles.
Below Demopolis for	107
Between Demopolis and Vienna for	48
Between Vienna and Columbus for	45
Total	200

There remains to be completed of this class of work—

	Miles.
Below Demopolis	30
Between Demopolis and Vienna	51
Between Vienna and Columbus	33
Total	114

But of this distance there are many stretches a mile or two in length where little or no work will be needed. On the other hand, on the completed sections, there are places needing revision. On Ten-Mile Shoals, for instance, at several points the river is again obstructed by trees thrown into the stream by the caving of the banks during the past winter's floods.

Forty-three bars have been improved, covering an aggregate length of 6 miles. Seven of them will need additional work, amounting to a total channel length of 0.56 mile.

Seventy-five bars remain to be improved, but the work needed on

them will probably not exceed in amount that done on the improvement already made.

The improvement, as far as perfected, has extended low-water navigation from Bladon 43 miles, to Durden's 264 miles, that is for summer boats drawing not over 2½ feet. It has also added two or three months to the length of the boating season to Columbus. Cutting the leaning timber and trimming the "short points," besides lessening the risk of damage to boats, has materially reduced the length of the trip from Mobile to Columbus. By clearing the river of logs the boats are able to run the upper river on 2 to 3 feet less water than formerly, and on the lower river night running is practicable at places heretofore passable in daylight only.

The balance of funds available for expenditure during the fiscal year ending June 30, 1884, will be used in continuing the work of removing logs and leaning timber.

It is thought that this class of work can be completed above Demopolis, and done to a useful extent below, before the funds are exhausted. The snagging of the river will then be so nearly completed that future work can be mainly devoted to bar improvement and to the protection of caving banks.

The amount that can be profitably expended during the fiscal year ending June 30, 1885, is:

Between Columbus and Vienna	$25,000
Between Vienna and Demopolis	30,000
Below Demopolis	45,000
Total	100,000

It is proposed to expend these amounts as follows:

First. In completing a 3-foot channel of not less than 35 feet width between Columbus and Vienna. In this work would be included the revetment of some caving banks on Ten-Mile Shoals and the blasting of a rock reef 6 miles above Vienna.

Second. In improving fifteen bars of least depth between Vienna and Demopolis, the probable effect being to give not less than 2½ feet depth on this division.

Third. In improving eight bars of least depth (two of them rock shoals) below Demopolis, with the expectation of securing a channel depth throughout of not less than 3¼ feet.

The estimated amount, exclusive of appropriations already made for the entire completion of the work, is:

Columbus to Vienna	$25,000
Vienna to Demopolis	30,000
Below Demopolis	45,000
Total	100,000

After the completion of the improvement, its maintenance will require an annual appropriation. As already explained, $10,000 will suffice for both the Tombigbee and Warrior.

The appropriations for this improvement have been made for the Warrior and Tombigbee jointly, as follows:

By act of March 3, 1875	$25,000
By act of August 14, 1876	15,000
By act of June 18, 1878	28,000
By act of March 3, 1879	20,000
By act of June 14, 1880	47,000
By act of March 3, 1881	25,000
By act of August 2, 1882	30,000
Total	190,000

Of this amount there has been assigned—

To the Warrior, below Tuscaloosa	$85,638 38
To the Tombigbee, below Columbus	104,361 62

Besides the items given in the attached commercial statistics, towboats have brought down timber-rafts, barges of resin, and flat-boats of staves to a much greater extent than formerly; but the amount and value could not be ascertained.

The business done by the Columbus boats has grown up within the three years.

As compared with last year's business, it has more than doubled. As to future increase, Billups & Banks, agents of the *Lotus No.* 2, say:

> The business can be doubled if the river can be made navigable ten months in the year.

Messrs. Moore & Cox write:

> The river has been so much improved during the past two years that we feel anxious that the comparatively little additional work should be done to give us an outlet for our cotton that is worth any two railroads that are or ever can be built.

A comparison with last year's business can only be made with respect to cotton. Between Mobile and Columbus there were transported last year 70,762 bales against 53,384 carried during the year preceding.

Money statement.

July 1, 1882, amount available	$7,932 69
Amount appropriated by act passed August 2, 1882	30,000 00
	37,932 69
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	28,116 10
July 1, 1883, amount available	9,816 59
Amount (estimated) required for completion of existing project	148,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	148,000 00

COMMERCIAL STATISTICS.

The business of this river during the past year has been done by five steamboats running from Mobile to Pickensville and points below, and two boats plying between Columbus and Miller's Landing, connecting at this latter point with the Alabama Great Southern Railroad.

The Mobile boats, with their tonnage, were:

	Tons.	Trips made.
Ruth	225	33
W. H. Gardner	275	44
D. L. Tally	375	22
Dove	125	39
Bradish Johnson	350	11

The Columbus boats were:

Lotus No. 2	175	31
Billy Collins	100	..

The following statement of the business done by the above boats was carefully compiled from their books, and, as far as it goes, may be relied on as accurate:

Articles.	Between Mobile and Pickensville.		Between Columbus and Miller's Landing.	
	No.	Approx. value.	No.	Approx. value.
Cotton.....bales..	53, 916	$2, 965, 380	16, 846	$926, 530
Bagging.....rolls..	6, 429	38, 574	.....	.....
Ties.....bundles..	11, 621	20, 337	2, 060	3, 605
Corn.....sacks..	22, 494	44, 998	800	1, 600
Oats.....do....	5, 637	14, 092	.....	.....
Flour.....barrels..	20, 097	140, 679	500	3, 500
Meat.....500 lb. boxes..	6, 169	308, 450	580	29, 000
Molasses.....barrels..	1, 358	33, 950	20	500
Sugar.....do....	2, 214	55, 210	20	500
Whisky.....do....	1, 442	86, 520	250	12, 500
Meal.....sacks..	9, 641	19, 282	.....	.....
Salt.....do....	7, 545	8, 300	800	800
Shingles.....M..	1, 011	3, 508	.....	.....
Lumber.....do....	520	7, 800	.....	.....
Staves.....number..	15, 070	1, 507	.....	.....
Rosin.....barrels..	10, 523	27, 605	.....	.....
Turpentine.....do....	1, 796	32, 400	.....	.....
Cotton seed.....sacks..	34, 593	31, 000	21, 185	20, 000
Coffee.....do....	2, 371	35, 550	.....	.....
Fertilizer.....tons..	1, 250	50, 000	260	10, 400
Hay.....bales..	804	3, 618	.....	.....
Sundries.....packages..	92, 066	450, 000	lbs., 2, 300, 000	125, 000
Totals.....	.....	3, 978, 790	.....	1, 133, 985

Passengers carried..... 20, 826

M 22.

IMPROVEMENT OF TOMBIGBEE RIVER ABOVE COLUMBUS, MISSISSIPPI.

The survey of the Tombigbee River, between Columbus and Fulton, Miss., was completed in 1873 under the direction of Maj. W. McFarland, Corps of Engineers, United States Army. The project adopted for the improvement of this portion of the river was to remove the snags, logs, and overhanging trees so as to enable steamboats to run between the points mentioned during high water, and the cost was estimated at $35,000.

The sum of $10,000 was appropriated for the improvement of the Tombigbee River by act of Congress approved March 3, 1873, of which $4,667.05 was expended by Major McFarland above Columbus, and the balance, under the direction of this office, on the lower part of this river.

No other work was done on the upper river until 1878. Commencing with that year this improvement was assigned to the charge of this office, and appropriations have been as follows:

Act of Congress approved June 18, 1878	$12, 000
Act of Congress approved March 3, 1879	10, 000
Act of Congress approved June 14, 1880	4, 000
Act of Congress approved March 3, 1881	1, 000
Act of Congress passed August 2, 1882	1, 000
	28, 000

Operations under these appropriations were commenced at Aberdeen, Miss., in 1878, and have been carried on from that time, during low-water seasons, to the close of this fiscal year, in accordance with the adopted pro-

ject. When the work was commenced the condition of the river was as follows: From Columbus, Miss., up to Aberdeen, 65 miles (estimated distance), navigation was difficult when the water was 12 feet above ordinary low water; between Aberdeen and Cotton Gin Port, 35 miles (estimated distance), there was only navigation for small barges, carrying about 125 bales of cotton; from Cotton Gin Port up to Fulton there was no navigation at all. The improvement, as projected, may be considered as completed, as there is now easy navigation for steamboats of 300 tons from Columbus up to Aberdeen when the water is 4 feet above the ordinary low-water stage, and from Aberdeen up to Fulton when it is 10 feet above.

During the fiscal year operations were confined to the preservation of the improvement.

The improvement is not permanent, but it is thought that an annual appropriation of $2,000, with the balance on hand, will preserve the improvement effected, and perhaps obtain a still better condition of the channel.

Three steamers have navigated the river as far up as Town Creek during the year, but no reliable statement of the amount or value of commerce has been obtained.

Money statement.

July 1, 1882, amount available	$4,373 40
Amount appropriated by act passed August 2, 1882	1,000 00
	5,373 40
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	4,548 56
July 1, 1883, amount available	824 84
Amount (estimated) required for preserving improvement	2,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	2,000 00

M 23.

IMPROVEMENT OF NOXUBEE RIVER, MISSISSIPPI.

The examination of this river provided for by act of Congress approved March 3, 1879, from Macon, Noxubee County, Miss., to its mouth, was made during the month of March, 1880, and report upon it is contained in the Annual Report of the Chief of Engineers for 1880.

The condition of the river when examined was such that during all seasons of the year and at all stages of the water navigation, except by small flat-boats, was practically impossible. Steamboats formerly plied upon the river, but after the building of the Mobile and Ohio Railroad they were withdrawn (1859). The river banks then became overgrown with timber, which in time fell or slid into the river, causing snags and logs to lodge on the river's bottom, and also caused the formation of a number of shoals and bars.

The river being virtually abandoned for the purposes of navigation, the planters living along its banks assisted in closing up its channelway by building a number of fish traps and mill-dams.

The chief obstructions consisted in the immense number of trees overhanging its banks, which appeared throughout its entire length, in some places being so dense as to roof the river in.

During the low-water season the average depth of the river is fully 3

feet, but there are a number of shoals and bars on which only 1½ and 2 feet of water can be found.

The river has an average width of 60 feet at low water; in some instances, however, this width is decreased by the formation of islands, which divide the river into two small streams. The general width is considerably increased during the season of high water.

The project adopted was designed to obtain a navigable channel during nine months of the year from its mouth to the city of Macon, Miss., by the removal of such overhanging timber and other obstructions as were to be found on that portion of the river.

The estimated cost was $65,245.25.

The appropriations for the work are as follows:

By act of Congress approved June 14, 1880	$12,000
By act of Congress approved March 3, 1881	8,000
By act of Congress passed August 2, 1882	10,000
Total	30,000

Work was commenced on the improvement during the low-water season of 1880, prosecuted through the fiscal years ending June 30, 1881, and 1882, and continued during the fiscal year ending June 30, 1883, until the funds available for the work were exhausted.

The work performed during the fiscal years ending June 1881, and 1882, was as follows:

Number of large overhanging trees removed	28,404
Number of large overhanging trees trimmed	1,724
Number of large stumps on the banks cut level	5,450
Number of logs on bank cut up (drift)	2,978
Number of logs and snags removed from river bed	2,857
Fish-traps and drifts removed	12
Quarter-boat built and equipped	1
Snag-boat built and equipped	1
Total number of miles worked over (partially improved)	74
Number of miles of river remaining to be worked over	17½

During the fiscal year ending June 30, 1883, the work of improvement, according to the plan adopted, was vigorously prosecuted until an exhaustion of the available funds rendered a suspension of operations necessary. The work accomplished is summarized as follows:

Number of large overhanging trees removed	9,939
Number of large overhanging trees trimmed	254
Number of large stumps on the bank cut level	1,220
Number of logs on the bank cut up (drift)	651
Number of logs and snags removed from river bed	763
Fish-traps removed	1
Mill-dams torn down and leveled to bottom of river	1
Total number of miles worked over (partially improved)	17½

Thereby completing a partially improved channel for high-water navigation over the entire distance contemplated in the plan of improvement.

Total work accomplished from commencement of improvement to end of the present fiscal year:

Number of large overhanging trees removed	38,343
Number of large overhanging trees trimmed	1,978
Number of large stumps on bank cut level	6,670
Number of logs on bank cut up (drift)	3,629
Number of logs and snags removed from river bed	3,620
Fish-traps and drifts removed	13
Mill-dams torn down and leveled to bottom	1
Quarter-boat built and equipped	1
Snag-boat built and equipped	1
Total number of miles worked over (partially improved)	91½

which comprises the entire distance contemplated in the plan of improvement.

On the first rise that occurred after the improvement of the river had become known, steamboats began to ply on the river, finding no difficulty whatever in going to the county bridge at Macon, Miss., and returning to the mouth of the river with fair loads of cotton and produce. The number of bales transported during the season was limited, owing to the low stage of water which prevailed at the time when the bulk of the cotton crop throughout the country was seeking a market.

This is the first successful attempt that has been made to navigate the river by steamboats from its mouth to Macon, Miss., within the last twenty-five years.

The sum of $25,000 can be profitably expended during the fiscal year ending June 30, 1885, in continuing the improvement by widening and deepening the channel, removing the snags and logs which will find their way into the bed of the river, removing the overhanging timber which will slide down the banks after every freshet, and in removing the large raft which formed at the head of the "cut-off" during a temporary suspension of the work of improvement.

On completing the improvement as designed the river during the high-water season will be navigable from its mouth to the town of Macon, Miss., thus furnishing a new and cheaper transportation route for the planters who reside on or are adjacent to the river for their cotton, produce, and supplies, the greater portion of which is hauled over the heavy prairie roads from long distances to the different stations on the Mobile and Ohio Railroad.

The work is not susceptible of permanent improvement, and will require an annual expenditure of at least $3,000 to maintain the river in the condition contemplated in the plan of improvement.

The amount of commerce, taking advantage of the short high-water season after the river was opened for navigation, was as follows:

Cotton	bales..	1,170
Oats	sacks..	289
Miscellaneous freight packages	pounds..	3,000

The reduction of freight on the above over the rates formerly charged by railroad amounted to $1,650, which benefit was directly felt by the planters living along and adjacent to the river.

The shipments over the river, now that it is opened for high-water navigation to the town of Macon, Miss., is estimated at about 16,000 to 18,000 bales of cotton, and an equal value of other products and return supplies.

The estimated value of commerce will be about as follows:

Say 16,000 bales of cotton, at $55 per bale	$880,000
Cotton-seed, corn, oats, and other products	100,000
Return merchandise and plantation supplies	784,000
Total	1,764,000

The average rate of freight, per Mobile and Ohio Railroad, from Macon and stations on the road that are within easy hauling distance of the river, has been about $3.75 per bale to Mobile. The rate by river, including insurance, &c., $2.50 per bale; the savings in freight, therefore, by the river route is $1.25 per bale. The savings of freight on the cotton that will presumably seek the river route will be about $20,000 per annum to the planters residing on the river. A corresponding decrease in the cost of transportation will also be felt in all lines of goods and merchandise transported, owing to the discrimination made between through and local rates by railroad.

The shipments over the river may possibly be increased by the im-

provement, furnishing the means of supplying coal to the inhabitants adjacent to the river from the coal fields of the Sipsey and Warrior rivers.

Money statement.

July 1, 1882, amount available	$1 55
Amount appropriated by act passed August 2, 1882	10,000 00
	10,001 55
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	9,356 24
July 1, 1883, amount available	645 31
Amount (estimated) required for completion of existing project	35,245 25
Amount that can be profitably expended in fiscal year ending June 30, 1885	25,000 00

M 24.

IMPROVEMENT OF PASCAGOULA RIVER, MISSISSIPPI.

In 1873 a plan for the improvement of this river at its mouth, by dredging a channel 200 feet wide and 7 feet deep at mean low water, was submitted by Lieutenant Quinn, U. S. A., but owing to various legal complications as to the ownership of what was then known as the Noyes Canal, nothing was done under the plans and specifications submitted until 1880, when a contract for dredging was awarded to Mr. S. N. Kimball under sundry appropriations amounting to $22,500.

In January, 1881, this amount was exhausted; 63,000 cubic yards of material were removed, giving a cut through the bar about 1 mile in length and 75 feet in width.

By an act of Congress approved June 14, 1880, the amount of $20,000 was appropriated to complete this work at the mouth by dredging and continuing the improvement of the river for its entire length by the removal of snags and overhanging trees. The second dredging contract was awarded to Mr. W. G. Mitchell in November, 1880, and was finished in March, 1882, leaving a balance on hand on July 1, 1882, of $2,345.72.

A channel was dredged through the bar at the mouth of the river 180 to 190 feet wide, 7½ to 8 feet deep at mean low water, enabling vessels to go up to the mills at Moss Point and load to this draught, thus saving large lighterage bills and claims for demurrage.

At the commencement of this work there were from 3 to 3½ feet on the bar at mean low water.

The dredged channel from late examination, and throughout the past year, has preserved its depth and has given entire satisfaction; at high tide a vessel drawing 9 feet can now be safely towed through.

A log-boat with steam capstan power was built in May, 1882, but operations were not begun until June for the improvement of the river above Moss Point owing to high water.

An amount of $8,000 for continuing this work was appropriated by an act of Congress August 2, 1882. Owing to continued high water, work was suspended from July 16 to August 21, after which time progress was steadily made until December 23, when the work was again suspended until May 27, 1883. It was feared that the excessive and long continued freshets in the river would carry in many obstructions, but recent inspections show that the banks have been remarkably well preserved from washings and cavings, and no obstructions can now be found of any importance from the mouth of the river at the light-house to Dead Lake, a distance of 50 miles worked up to December, 1882. At extreme low water a boat drawing 6 to 7 feet can now be safely navi-

gated as far as the log-boat has gone. The banks are free from overhanging timber, and all trees likely to go in the river by caving have been cut down or girdled. The following statement will show an aggregate of work for the fiscal year ending June 30, 1883:

Snags removed	1,083
Trees cut	3,724
Trees trimmed	540
Trees girdled	1,403
Distance worked over ..... miles..	58

The lands immediately along the river banks are very rich and abound in fine swamp and ridge timber of many varieties, as follows: Hickory, red, white, live and water oaks, red and white elm, ash, poplar, black gum, maple, birch, tupelo gum, cypress, magnolia, willow (in abundance, long and suitable for mattress work), beach, cottonwood, spruce, and long-leaf pine, red and white bay, iron wood, cane and tiger alders, (along the banks in the swamp sections, good protections to the banks.)

The naval store business has largely increased during the past year, and when the facilities for transportation now in contemplation are effected, this branch of industry will be greatly enlarged.

Since the beginning of the work of improvement large sales of Government and State lands have been made to capitalists (American and foreign), adjacent to the river, and the continuance of the work will offer further inducements for investments for the development of the resources of this richly timbered section. Steamers are now being built to put in the carrying trade to points above. Real estate has advanced both at Scranton and Moss Point fully 25 per cent. during the past twenty-two months, and it is safe to say fully one-third has been added to their population. Two large mills have been constructed at Moss Point recently, and as many as one hundred new dwelling-houses have been erected during the last fiscal year.

With the unexpended balance and the funds that may be available during the next fiscal year, it is proposed to continue the work of improvement under the present plan, and as the work advances very beneficial results are expected to ensue.

The sum of $10,000 can be profitably expended during the next fiscal year, and this amount will suffice to complete the improvement under the present project.

This work is situated in the collection district of Shieldsborough, Miss., Pascagoula being the port of entry, where there is stationed a deputy United States collector of customs.

Money statement.

July 1, 1882, amount available	$2,345 72	
Amount appropriated by act passed August 2, 1882	8,000 00	
		10,345 72
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	6,987 41	
July 1, 1883, amount available	3,358 31	
Amount (estimated) required for completion of existing project	10,000 00	
Amount that can be profitably expended in fiscal year ending June 30, 1885	10,000 00	

COMMERCIAL STATISTICS.

The following custom-house statistics shows the number of vessels entered and cleared from the port of Pascagoula during the year, value of cargoes, &c., to which must be added the coastwise trade. The appended table also gives the tonnage employed on the river, also the approximate amount of merchandise imported to Scranton, Moss Point, and to points up the Pascagoula River.

Comparative custom-house returns for Pascagoula River.—Entrances and clearances from and to foreign countries.

Entrances.			Clearances.		
Years.	No. of vessels.	Tons.	Years.	No. of vessels.	Tons.
1879	64	22, 386	1879	61	22, 916
1880	61	23, 731	1880	64	24, 491
1881	108	47, 640	1881	93	40, 381
1882	105	59, 226	1882	135	74, 151
1883	89	41, 657	1883	94	44, 842

Custom-house receipts from all sources during the fiscal year ending June 30, 1883, $9,976.72.

LIST OF CLEARANCES AND STATEMENT OF LUMBER SHIPMENTS FROM PASCAGOULA, MISSISSIPPI, FISCAL YEAR ENDING JUNE 30, 1883.

Number of vessels	94
Tons	44, 842
Superficial feet	18, 435, 280
Value	$250, 277
Cubic feet	1, 117, 648
Value	$140, 066
Shingles	223, 000
Value	$1, 655

SHIPMENTS TO NEW ORLEANS AND COASTWISE.

Lumber:	
Superficial feet	6. 145, 093
Value	$49, 160 74
Cubic feet	200, 000
Value	$30, 000 00

Approximate tonnage of Pascagoula River, Mississippi.

Number of vessels.	Character.	Total tonnage.
10	Steam-tugs	421. 39
15	Schooners (large)	1, 550. 00
30	Schooners (small)	750. 00
25	Barges	2, 500. 00
	Total	5, 221. 39

Shipments of charcoal, naval stores, wood, &c., from Pascagoula River, during the fiscal year ending June 30, 1883.

Articles.	Barrels.	Cords.	Value.
Charcoal	660, 000	.....	$95, 000
Naval stores:			
Rosin	8, 000	.....	16, 000
Spirits turpentine	2, 000	.....	28, 000
Wood	.....	8, 000	24, 000
Total	.....	.....	163, 000

RECAPITULATION.

Total value of shipments:	
Lumber and shingles	$520, 319 48
Charcoal, naval stores, wood, &c	163, 000 00
Creosoted piles, lumber, and cross-ties	45, 000 00
	728, 319 48

Approximate value of merchandise received at Scranton, Moss Point, and along the Pascagoula River, $350,000.

M 25.

IMPROVEMENT OF MANATEE RIVER, FLORIDA.

The examination of this river provided for in section 3, river and harbor act March 3, 1881, was made in September, 1881, and report thereof forwarded February 16, 1882, and is contained in Annual Report Chief of Engineers, 1882, Appendix K 25.

This river flows into Tampa Bay on its southern shore, and at the time of the examination showed a depth of 8 feet at ordinary low water.

Based upon this examination an appropriation of $12,000 was made by act of Congress, passed August 2, 1882.

A project was submitted and adopted for the prosecution of this work of improvement, having for its design the obtaining of a channel 13 feet in depth at ordinary low water from Tampa Bay up to Shaw's and McNeil's points, the improvement to be effected by dredging at an estimated cost of about $70,000.

Advertisements for proposals for dredging were published August 30, 1882, and opened September 30, abstracts of which were forwarded on day of opening, and it was recommended that the contract be awarded to Mr. John Maguire, of Mobile, Ala., the lowest bidder, at 49$\frac{9}{10}$ cents per cubic yard. The contract was not awarded until March 9, 1883, action being deferred by Chief of Engineers.

Mr. Maguire commenced dredging under his contract April 2, 1883, and continued until May 14, when a break occurring in the machinery of his plant, there being no facilities for repair nearer than Pensacola, he was allowed to temporarily suspend operations; 2,405 cubic yards of material were removed.

Work was not resumed during the fiscal year.

The benefit to commerce to be derived from the completion of this improvement is the increased facilities for shipments of the products of the county, mostly fruits and other perishable products, and it is reasonable to infer that this would cause a large influx of population and a corresponding increase of productions.

It is proposed during next fiscal year to apply the available funds to prosecute the work of dredging as proposed in adopted plan.

The sum of $58,000 can be profitably expended during the fiscal year ending June 30, 1885, to be used in securing a 13-foot channel from Tampa Bay to Shaw's Point and McNeil's Point.

No commercial statistics have been obtained; consequently the possible increase in commerce cannot be estimated.

This improvement is in the collection district of Key West, and Key West is the port of entry.

Money statement.

Amount appropriated by act passed August 2, 1882		$12,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	$3,038 99	
July 1, 1883, outstanding liabilities	176 23	
		3,215 22
July 1, 1883, amount available		8,784 78
Amount (estimated) required for completion of existing project		58,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885		58,000 00

Abstract of bids received and opened September 30, 1882, *for dredging at Manatee River, Florida.*

No.	Names of bidders.	Price.	Date of commencement.	Date of completion.
		Per cu.yd.		
1	Rittenhouse Moore	$0 55	In accordance with specifications.	In accordance with specifications.
2	S. N. Kimball	50	....do	Do.
3	John Maguire	49 9/10	....do	Do.
4	James E. Slaughter	52½	....do	Do.

M 26.

IMPROVEMENT OF ROADSTEAD THAT LEADS INTO THE BACK BAY OF BILOXI, MISSISSIPPI.

The examination of this roadstead, provided for by the third section of the river and harbor act of March 3, 1881, was made during the months of August and September, 1881, report of which is contained in Annual Report Chief of Engineers for 1882, Appendix K 27.

The examination showed that between the roadstead and the Back Bay are situated a series of mud flats, called "Deer Island Flats," distant about 1¼ miles east of Biloxi, having a present depth of 4 feet.

The result desired to be secured is the dredging of a channel of 8 feet depth through these flats, at an estimated cost of $35,000.

Based upon this examination an appropriation of $5,000 was made by act of Congress passed August 2, 1882.

This amount was deemed insufficient for an economical prosecution of the work, and upon such representation to the Chief of Engineers authority was obtained under date September 25, 1882, to defer all action until a further appropriation is made.

No work is proposed for next year, Congress having failed to make an additional appropriation.

This improvement when completed will give a channel of 8 feet, through the flats, enabling vessels of larger draught than now enter the Back Bay to reach the canning factory on the bay and the large mills on Biloxi River.

The work is not susceptible of permanent improvement.

It would be difficult at present to estimate the increase to the commerce likely to ensue from the completion of this improvement, but as there is a large influx of capitalists engaged in milling and other enterprises, it is reasonable to suppose that the benefit will be largely in excess of the cost of improvement.

This work is situated in collection district of Shieldsborough. Shieldsborough is the nearest port of entry.

Money statement.

Amount appropriated by act passed August 2, 1882	$5,000 00
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	11 45
July 1, 1883, amount available	4,988 55
Amount (estimated) required for completion of existing project	30,000·00
Amount that can be profitably expended in fiscal year ending June 30, 1885	30,000 00

APPENDIX N.

INSPECTION OF THE IMPROVEMENT AT THE SOUTH PASS OF THE MISSISSIPPI RIVER.

REPORT OF CAPTAIN WILLIAM H. HEUER, CORPS OF ENGINEERS, INSPECTING OFFICER, FOR THE FISCAL YEAR ENDING JUNE 30, 1883.

OFFICE UNITED STATES ENGINEER,
New Orleans, La., July 23, 1883.

GENERAL: I have the honor to transmit the annual report of the progress of the work on the improvement of the South Pass of the Mississippi River.

Mr. C. Donovan, assistant engineer, has remained in local charge of the work of examinations and surveys of the Pass during the year, and in his report accompanying this will be found full details of all changes which have occurred.

Except for five days in July, 1882, there has been a channel between the jetties having a least depth of 30 feet of water in it, and the 26-foot deep channel in the jetties had, during the year, except for nine days in July, 1882, a least width of 200 feet. At present there is a 31-foot depth of channel in the jetties, and the least width of the 30-foot channel is 90 feet. The least width of the 26-foot channel is 240 feet.

In the pass itself there is a channel 27 feet deep, and the 26-foot channel in the pass has a least width of 160 feet. In other words, there is now a channel at least 160 feet wide and having a least depth of 26 feet of water in it from the Gulf into the main river. This is the best channel that has ever been found since the jetties were constructed.

But seventeen days' dredging has been done on the work during the year, of which five days was in the pass, nine days in the jetties, and four days on mud lump outside of jetties.

The 30-foot channel within the jetties has much improved during the year; for a small portion of the year the narrowest part of this channel was only 15 feet in width; this has increased until now its least width anywhere is 90 feet. The improvement is attributed to the construction of an inner jetty built parallel to and about 200 feet inside of the east jetty; the length of this inner jetty is 6,810 feet. While the inner jetty has improved the channels in the jetties, it has reduced the width of the water-way between the jetties to 630 feet. Before the wing-dams, cribs, and inner jetty were built the water-way was about 1,000 feet in width.

In September last a cyclone passed over the jetties and worked much damage to the east jetty. About one-half mile in length of the con-

crete wall on this jetty was badly broken up. Some idea of its force may be imagined from the fact that solid concrete blocks, estimated to weigh 28 tons, were, from the action of the sea, torn from the jetty, while others were turned bottom upwards. Fortunately, the inner jetty had been constructed opposite to where the damage occurred, so that the channel within the jetties remained uninjured.

Surveys beyond the ends of the jetties extending out to 100-foot depth of water, made during the year, show a very little change to have occurred on what is sometimes called the bar. The little diagrams of Mr. Donovan's report show at a glance what these changes are.

To the jetties proper no work has been done during the year. Within the jetties work has been confined to building the inner jetty and to building five wing-dams, projecting from the east jetty. The new work is shown on Chart No. 1.

In the pass proper eleven new wing-dams have been built; one at Crane Island, three near Goat Island, and seven near Bayou Grande. They varied from 20 to 250 feet in length.

At each of the places where these dams were built the pass was wide and shoaler than in the narrower parts of the pass. In fact, at each of the localities improved, the depth of water in the channel was hardly an inch more than the 26 feet of depth required. After the dams were built the current rapidly scoured out the crests of these shoals until a depth of 32 feet of water was obtained.

Chart No. 7 gives longitudinal profiles through the pass and jetties for 1875 and 1882, and shows at a glance what an amount of filling or deposit has taken place in the pass since 1875, and what a scour has obtained within the jetties.

At the head of the South Pass there is now a fine channel 400 feet wide and having a least depth of 30 feet.

The channels at the heads of Southwest Pass and Pass à l'Outre are also increasing in depth, but the bars at the mouth of these passes are reported as being very shoal. That at Southwest Pass is reported as having only a 12-foot channel through it, while Pass à l'Outre Bar is said to have but 8 feet depth. Both of these passes are now so little used that but little is definitely known about them except where our surveys cut into them near their heads.

During the year ten vessels have been reported as having been aground in the pass, jetties, or near the jetties.

As soon as practicable our surveyors located the positions of these vessels on our charts, and in every instance the vessels were found to be out of the channel, which was amply wide, deep, and practicable. Chart No. 6 shows the steamer City of Lincoln aground in her various positions with good deep water in the channel close alongside.

Attention is earnestly invited to the fact that Congress requires "examinations and surveys to ascertain the depths of water and widths of channel secured and maintained from time to time by James B. Eads at South Pass and the jetties" to be made, but owing to the failure of the last river and harbor bill the amount of money now available for this work for the balance of the fiscal year ending June 30, 1884, is only $5,948.94, whereas the amount required to make the examination and surveys is $11,948.94.

It is thought that the present funds will suffice to continue the work required until December 1, 1883.

My acknowledgments are due to Mr. Donovan and his assistants for services well performed during the year.

ESTIMATE OF FUNDS REQUIRED FOR EXAMINATIONS AND SURVEYS AT SOUTH PASS OF THE MISSISSIPPI RIVER DURING THE FISCAL YEAR ENDING JUNE 30, 1885.

2 assistant engineers	$3,925
1 recorder	1,080
1 clerk	900
1 steam engineer	1,200
1 water-level observer	120
6 seamen	4,740
Rent of office	180
Rent of assistant engineers' quarters	240
Mileage and traveling expenses	150
Fuel for launches	400
Repairs to launches and boats	1,500
Materials and supplies for launches	400
Stationery and supplies for office	200
Contingencies	2,500
Total	17,535

Money statement.

July 1, 1882, amount available	$6,239	44
Amount appropriated by act passed August 2, 1882	10,000	00
	16,239	44
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	10,290	50
July 1, 1883, amount available	5,948	94
Amount required for fiscal year ending June 30, 1884	6,000	00
Amount required for fiscal year ending June 30, 1885	17,535	00

Respectfully submitted.

W. H. HEUER,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MR. C. DONOVAN, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Port Eads, La., July 21, 1883.

SIR: I have the honor to report upon the condition of the works (on June 30, 1883) constructed by Mr. James B. Eads for the improvement of South Pass of the Mississippi River, and also the amount and character of the work done during the fiscal year to maintain said works and the channel created by them. The results of examinations and surveys made during the year are given herein, together with the results of comparisons made with similar and earlier results, at the Head of the Passes, throughout South Pass, and in the Gulf of Mexico.

The following charts and plates accompany this report:

No. 1.—Chart of channel from opposite South Pass light-house to the end of the jetties.

No. 2.—Chart of a part of the Gulf of Mexico, showing depths out to 100 feet.

No. 3.—Chart of South Pass, from South Pass light-house to Bayou Grande.

No. 4.—Chart of South Pass, from Bayou Grande to Head of Passes.

No. 5.—Chart of the Head of Passes.

No. 6.—Miscellaneous plans, sections, &c.

No. 7.—Plan and comparative profiles of South Pass.

Plate I.—Diagrams showing changes in the Gulf.

Plate II.—Diagrams showing changes in the Gulf from 1876 to 1883.

AT THE HEAD OF THE PASSES.

No work has been done at this point since July, 1879, and no changes of note have occurred in the condition of the works during the year. The piling for 120 feet in length from the east end of upper dam has washed out, and the aggregate length of the portions of this dam where the piling still remains is 780 feet. (See Chart No. 5.) The foundation mattresses are still in place where the piling is gone, and have a depth of 23 feet of water over them. The mattress work in all the structures is below average flood tide, and with the exception of upper dam and portions of east and west T-heads, they are entirely buried by sedimentary deposits.

Mattress sills across Southwest and Northeast Passes.—These sills are still in place; portion of Southwest Pass sill over a length of 1,600 feet from the east end indicate a

settlement of about 2 feet, otherwise there has been no material change in these structures during the year.

IN SOUTH PASS.

During the month of March a dam 90 feet in length was built near the foot of Crane Island, extending into the channel for the purpose of diverting the current from the shore of the island, and causing it to scour away the west shore opposite and below the dam, and thus straighten the channel through this reach. This dam consists of two rows of piles driven 6 feet apart, the piles in each row being also 6 feet apart; those in the lower row being connected by a 12 by 12 inch waling piece, and five piles were driven as braces; the space between the two rows of piles was then filled with loose willows, which were ballasted with gravel. There were used in the construction of this dam forty-one piles, 1,560 feet, board measure, waling timber, 47 cords of willows, 118 cubic yards of stone, and 81 cubic yards of gravel. For location of dam see Chart No. 5.

Above Goat Island.—During the months of December and January dams were built in the pass above Goat Island, while others previously built were reconstructed, and one was built to cut off the channel around the island, and all for the purpose of decreasing the width of section, and thereby increase the depth through this reach. By these structures the width of sections at which they were built has been decreased 200 feet, and the channel has increased in depth from 26 to 32 feet. The locations of these dams and all others in this locality, with their present lengths, are shown on Chart No. 4.

Dam No. 5 was first built of piles and lattice work, and afterwards converted into what is termed a "solid dam" by driving another row of piles parallel to those already in place, and 6 feet from them, and filling in between the two rows with willows. This dam was 233 feet long, but it is gradually giving away as the strong current undermines it.

Dam No. 6, which effectually closes the channel around Goat Island, is 250 feet long, and consists of two rows of piles 4½ feet apart, the piles in each row being 6 feet apart. The piles in the lower row are connected by 12 by 12 inch waling timbers, and the space between the two rows is filled with willows, which are ballasted with gravel.

Dams Nos. 7 and 8 are constructed in the same manner as No 6, the two rows of piles being 6 feet apart. Their lengths are respectively 240 feet and 100 feet.

Dam No. 1, which was built of piles and lattice work, in March, 1881, has been converted into a "solid dam" in the same manner as No. 5.

There were used in the construction of the above-mentioned dams 298 piles, 7,934 feet board-measure waling timber, 6,809 feet board-measure scantling, 743 carriage bolts, 728 cords of willows, and 237 cubic yards of gravel.

Near Bayou Grande.—Since December seven dams have been built in the pass, in the vicinity of Bayou Grande, and one across the bayou at its head, effecting almost a complete closure of this outlet. These dams, like others already described, consist of two rows of piles 6 feet apart, the piles in each row being also 6 feet apart, and the space between the rows of piles is filled with willows laid parallel to the rows of piling. By these dams the average width of the sections at which they are built has been reduced 235 feet, and are now 612 feet.

The locations of these dams are shown on Chart No. 4; the distance from the upper to the lower one, or the length of pass which they have improved, is 4,300 feet.

The following table gives the lengths of, and materials used in, the construction of these dams:

Number of dam.	Length.	Piles.	Waling timber.	Willows.	Gravel.	Stone.
	Feet.	*Number.*	*Ft. B. M.*	*Cords.*	*Cu. yds.*	*Cu. yds.*
2	250	29	.....	260	577	43
3	108	42	1,800	122	.....	.....
4	72	26	924	74	.....	.....
5	195	60	2,520	108	.....	.....
6	193	61	2,592	157	.....	.....
7	256	85	2,880	158	119	.....
8	114	30	.....	99	.....	47
9	74	21	.....	84	.....	28
Totals	1,262	354	10,716	1,062	696	118

Some of the stone used in the above-named dams, as in all structures during the year, was taken from the west jetty, where it is no longer needed; the remainder, together with gravel and other like material, was discharged as ballast from vessels here.

DAMS ACROSS PICAYUNE BAYOU.

This dam, which was built in August, 1881, and fully described in my last report

(see Appendix L, page 1332, of Report of the Chief of Engineers for 1882), is still in good condition.

AT THE MOUTH OF SOUTH PASS.

No work has been done on the jetties proper during the year, and they may be said to have been abandoned for the less substantial work (the inner jetty) which they will protect from the force of the sea, while the latter confines the flow to a channel narrower and more uniform in width, and thus increases the depth, and maintains it more uniformly.

THE CONDITION OF THE ORIGINAL OR MAIN JETTIES.

In this connection I will give an account of the storm which occurred here on September 9, 1882, as the present condition of the east jetty is due to the effects of that storm.

On September 8 the signal officer here received a message from headquarters warning all vessels leaving Gulf ports that they would meet with dangerous winds in the Gulf. At that time the wind was blowing from the south and southeast, fresh, and continued so till about 10 o'clock on the night of the 8th, when it began to increase in velocity, the direction having changed to north-northeast. About 5 o'clock on the morning of the 9th the indications of approaching storm were such that preparations were made in anticipation of a serious time. All vessels, dredge-boats, tugs, &c., were in readiness; the inhabitants left their respective homes and took refuge in the hotel, and to reach said place they had to wade through water knee deep, for the tide had risen so that water covered the highest land here, and the walks were floated away. The tide was 2 feet above our plane of "average flood tide" and five-tenths of a foot higher than the highest tide recorded here. The storm continued with great fury till about 4 o'clock p. m., when it began to subside. The wind varied but little from a northeasterly direction, increasing gradually in velocity from 31 miles per hour at 10 o'clock p. m. on the 8th, attaining the greatest velocity from 10 to 11 o'clock a. m. on the 9th; and from this time it decreased gradually to 21 miles per hour at 6 o'clock p. m. The maximum velocity obtained between 10 and 10.30 o'clock a. m. on the 9th, was as follows:

For 5 minutes at the rate of 108 miles per hour.
For 10 minutes at the rate of 102 miles per hour.
For 15 minutes at the rate of 92 miles per hour.
For 30 minutes at the rate of 86 miles per hour.
For 15 hours the velocity was more than 40 miles per hour.
For 11 hours the velocity was more than 50 miles per hour.
For 7 hours the velocity was more than 60 miles per hour.
For 4 hours the velocity was more than 70 miles per hour.
For 1 hour the velocity was more than 80 miles per hour.

The damage done to the jetties was confined to the east one; on this jetty there were 5,432 linear feet of masonry which rested upon a foundation of mattresses, and consisted of blocks of concrete capped by a parapet wall. The force of the wind and sea was directed against this work nearly at right angles to it, and, in consequence, many of the blocks with their capping were turned over on their sides, and one was turned bottom side up, while others still retaining an upright position were twisted one way and another out of line.

On Chart No. 6 is given a sketch showing in detail the damages done to the east jetty, and in connection therewith is the record of the wind during the storm.

	Feet.
Length of wall badly broken up	2,430
Length of wall slightly damaged	500
Length where parapet only is destroyed	110
Total length of wall damaged	3,040
Total length of wall uninjured	2,392
Total length of wall built originally	5,432

The masonry which is damaged is by no means destroyed to that extent that it is not effectual in protecting the inner jetty from the force of the heavy seas, for as long as it remains as it is at present it will serve as such protection.

From an inspection of Chart No. 1 it will be seen that 5,700 feet in length of the east jetty and 4,800 feet of the west jetty are securely protected, and, in fact, buried by sedimentary deposits which have accumulated on either side of them. We have then in this connection, and aside from what has already been said, only to consider the settlement of the concrete work on the remaining portions.

The subsidence of the portions of the concrete wall on the east jetty which were not damaged by storm has been as follows:

	Feet.
Average subsidence during the year	0.25
Average subsidence for three years	1.12

On the west jetty there are one hundred and fifty-four blocks of concrete. Their subsidence has been as follows:

	Feet.
Average subsidence during the year	0.27
Average subsidence for four years	1.28

INNER EAST JETTY.

This structure has been the subject of most of the work done during the year. It is extremely simple in construction, consisting as it does of two rows of piles 6 feet apart, the piles in each row being the same distance apart and projecting about 6 feet above the surface of the water at "average flood tide."

The space between the piles is filled with willows laid in courses, crossing each other in various directions, so that each course may bind the other, and the whole be firmly interwoven between the piles. The first course is laid with their lengths at right angles to the line of piles, their but-ends being alternately on the line of one row and then on the other, the willows being about 15 feet long. This gives a foundation 23 feet wide.

This work commences 420 feet below East Point, and is built continuously for a distance of 1,940 feet, being nearly parallel to the main east jetty, and generally 200 feet from it; then it begins again 5,800 feet below East Point, and is built continuously for a distance of 4,870 feet, down to wing-dam 22; below wing-dam 17 a third row of piles is added to give greater stability below this point, where the work is more exposed and the water is deeper. In some places the willows are weighted with stone, which is removed after they have settled to the surface of the water, and more willow added. The upper surface is kept about 4 feet above average flood tide.

During the year a total length of 6,810 feet of this jetty was completed, though additional willows will be required from time to time accordingly as those now in place settle down to the surface of the water. In its construction 2,226 piles and 10,857 cords of willows were used. This work proves to be very substantial, and will eventually be continuous from East Point down to the present ends of the jetties. For the locations of the portions now in place, see Chart No. 1.

WING-DAMS.

Five new wing-dams have been built during the year, namely, Nos. 20, 21, 22, 23, and 24, all of which project from the east jetty, and seven others, which were built of lattice-work last year, have been reconstructed, so that these twelve dams are now of the same character as those built in the pass, and also the same in construction as the inner east jetty.

The location of these dams, as of all others which are serviceable, are shown on Chart No. 1; their numbers corresponding with those on the chart are given in the following table: .

Table giving the amount of material used in the construction of wing-dams.

Number of dam.	Length of dam.	Material used.			Number cords of willows.
		Number of piles.	Number linear feet 12 by 12 inch walking timber.	Number feet B. M. 2 by 6 inch scantling.	
	Feet.				
1	129	19	210	.....	187
9	218	32	175	.....	120
10	206	37	260	.....	120
11	200	21	180	400	161
12	210	30	.....	.....	187
13	200	26	.....	.....	160
17	212	31	.....	.....	233
20	100	28	195	3,150	142
21	190	2	.....	.....	149
22	168	56	.....	.....	234
23	200	62	240	.....	586
24	175	22	.....	.....	130
Total	2,208	366	1,260	3,550	2,409

There were also used in these dams 30 feet of three-quarter-inch chain, 103 feet three-quarter-inch round iron made into bolts, and 334 carriage bolts.

DREDGING.

The dredging done at different localities during the year has amounted in time to seventeen days of ten hours each, as follows:

Five days in the pass itself above Goat Island.
Nine days in the channel "through the jetties."
Three days on lump beyond the ends of the jetties.
From October 23, 1882, up to the present time, but eight hours dredging have been done, and since February 22 last the boat has not left her wharf for the purpose of dredging the channel.

THE PLANT.

During the year one tug-boat has been purchased and one small launch built; another tug-boat and launch repaired; one small flat-boat was built, two repaired, and four barges repaired; the dredge Bayley and one derrick-boat repaired. On the night of September 30 the carpenter shop was struck by lightning and, together with its contents, consisting of tools and general supplies, was destroyed; this has since been rebuilt; eleven piles were driven at the coal yard, and seven along the bank of the pass for mooring barges, &c.

Other work has been done by the force employed here, though it was not necessarily a part of the plant connected with the jetties; it is as follows: Two dwelling-houses built, several repaired, and a portion of one moved and converted into a school-house; also, house and wharf built for the use of pilots.

The work of discharging ballast from vessels and distributing the same has, at times, been done, when the force was not otherwise engaged.

FORCE EMPLOYED.

The average force employed during the year, including officers, mechanics, foremen, laborers, &c., has been sixty-seven in number.

EXAMINATIONS AND SURVEYS.

The results of examinations and surveys made during the year have been reported monthly, and the charts of my latest and more extended surveys (made in June), together with the results of comparisons made with those of earlier date, are given in this report. I endeavor to make the charts, graphical representations, tabulated statements, &c., in such a way that in themselves they embody what, without them, would be a long and unintelligible report, and since this subject has been so fully treated in previous reports, it will be superfluous to do more than to make general statements, to aid in a clearer understanding of the results.

AT THE HEAD OF PASSES.

The chart of the survey in this locality is No. 5.

As compared with last year's survey, Northeast Pass has shoaled in some places and deepened in others.

On section G H (see Chart No. 6) there has been a shoaling, varying from 1 to 5 feet, extending 2,400 feet from the east shore. From this point to the center of this section there has been a marked deepening, varying from 1 to 10 feet. The 26-foot curve has moved to the westward about 200 feet, and the 30-foot curve about 100 feet, the change being mostly above the mattress sill, while below the sill there has been a deepening of 2 feet during the year. As compared with the results in 1875, this pass has deepened an amount varying from 3 to 7 feet above the sill, and from 4 to 13 feet below it (see profile E F, Chart No. 6).

The western 26-foot curve defining the channel in Southwest Pass has changed but little below the mattress-sill and for a distance of 1,600 feet above it; but, above this point it has moved to the eastward 300 to 500 feet. Section C D indicates a deepening varying from 1 to 3 feet above the sill, and from 4 to 7 feet below it, and it will be seen that this change has taken place mostly during the year. Since 1875 this pass shows a quite uniform deepening of 3 feet above the sill and 3 to 10 feet below it.

The changes during the year in the channel from the main river into South Pass are apparent from an inspection of profile A B (Chart No. 6). From a point 400 feet above upper dam down to opposite head of passes light-house there has been a deepening varying from 5 to 20 feet, and opposite to and just below upper dam a hole having a depth of 121 feet has scoured. This results from the main current meeting the current through the break in the east T-head extension, causing strong whirls and eddies in this locality; and from a like cause the depth in the channel opposite the light-house has been increased to 58 feet, but below this point the channel has shoaled about 6 feet.

The greatest change during the year has taken place immediately above upper dam. Although but little less of this dam is in place now than last year, yet the changes this year have been just to the contrary of what they were during the previous year. This dam first broke in December, 1879, and during the year 1880 and 1881 the area above it deepened, but from 1881 to 1882 it shoaled an amount in excess of the deepening of the previous year, and it seemed quite evident that this shoaling would continue as long as the lower mattresses of the dam were in place, but the results of the past year show quite to the contrary, as this previous shoaling has nearly all been erased, and there is now but 500 feet in length of section I J (250 feet above the dam), which has a less depth than there was before the dam was built.

As a general result the channels at the head of the passes are deepening. According to section G H, the main river 2,120 feet above upper dam is decreasing in width while the depth is correspondingly increasing; the deepest water is in the center of the section, which point is directly above upper dam. Northeast Pass has the deepest entrance from the main river, though the channel into South and Southwest passes is now 30 feet deep and 400 feet wide, which is the greatest depth and width ever obtained from the main river into these passes, at least, since 1875.

SURVEY OF SOUTH PASS FROM ITS HEAD TO SOUTH PASS LIGHT-HOUSE.

During the month of November while the river was at its low stage I made a complete survey of South Pass, the charts of which are Nos. 3 and 4. As compared with the survey made one year previous the result is a slight shoaling, there having been a deepening in some localities and a shoaling in others, but on the whole there was no important change at any locality, until wing-dams were built to improve sections near Bayou Grande and above Goat Island. Since then these sections have improved rapidly.

As compared with the survey made in 1875 there has been a decided shoaling throughout the pass, as will be seen from inspection of Chart No. 7. From the comparative profiles given thereon, the amount of the shoaling at each particular locality may be ascertained and more clearly understood than by any other method of comparison. Above Grande Bayou the shoaling varies from 5 to 10 feet, and below the bayou from 2 to 5 feet, down to Picayune Bayou, below which point the result is a deepening.

The comparative profiles extend to the present ends of the jetties, and give one a good idea of the large amount of material scoured out from between the jetties since they were built.

During the year the depth and width of the channel near Bayou Grande and above Goat Island has fluctuated, but at all times the required channel has been maintained.

According to my surveys of June 16, the following channel dimensions obtained at these localities, namely:

Above Goat Island, least depth, 32 feet; least width of 26-foot channel, 300 feet; least width of 30-foot channel, least depth 200 feet.

Near Bayou Grande, least depth 27.1 feet; least width of 26-foot channel, 160 feet.

During the past two months I have noted sudden changes in the pass near Grande Bayou, and at a locality 1½ miles above South Pass light-house (marked △ Upper Base, on Chart No. 3), more particularly at the latter locality, and between it and Picayune Bayou.

Frequent surveys have developed the fact that these shoalings and changes in the channel are but the temporary lodgment of sand waves moving along the bottom. Vessels have grounded near △ Upper Base and between it and Picayune Bayou, because of the changes, but more particularly because of the lack of knowledge on a part of the pilots concerning them, for in no case have I failed to find a sufficient and the required depth of water soon after the vessel grounded.

My survey, made July 9, shows a channel through the reach, from △ Upper Base to Picayune Bayou having a least depth of 27 feet, the least width of the 26-foot channel being 170 feet.

According to the above statements, which are based upon the results of my latest surveys, there is a channel throughout South Pass in no place less than 27 feet deep, the 26-foot channel being not less than 160 feet wide. At other localities than those especially mentioned the depth and width of channel is substantially as shown on Charts 3 and 4.

THE CHANNEL THROUGH THE JETTIES.

The channel through the jetties is shown on Chart No. 1. In Appendix A I have given copies of the certificates which you have issued during the year, as they give information regarding the maintenance of channel not only through the jetties but throughout the pass.

The changes in the depth and width of this channel during the year will be seen from the following table:

Tabulated statements regarding the minimum depths and widths of channel through the jetties, in separate reaches of 2,000 feet each, according to surveys made monthly during the fiscal year ending June 30, 1883.

Date on which soundings were made.	Distances from East Point, in feet.																	
	0–2,000.			2,000—4,000.			4,000—6,000.			6,000—8,000.			8,000—10,000.			10,000—12,000.		
	Least depth.	Least width for—		Least depth.	Least width for—		Least depth.	Least width for—		Least depth.	Least width for—		Least depth.	Least width for—		Least depth.	Least width for—	
		26-foot depth.	30-foot depth.		26-foot depth.	30-foot depth.		26-foot depth.	30-foot depth.		26-foot depth.	30-foot depth.		26-foot depth.	30-foot depth.		26-foot depth.	30-foot depth.
1882.																		
June	30.8	250	60	35.5	320	120	39.0	370	300	31.2	300	180	31.3	290	90	31.0	210	80
July	30.0	240	15	32.7	300	60	38.7	380	320	30.6	240	140	31.3	270	90	31.5	200	70
August	30.3	290	50	32.2	300	110	38.1	370	250	31.8	280	160	31.8	300	160	30.5	230	100
September	30.1	215	55	31.5	300	110	38.3	380	290	31.9	250	140	30.8	270	80	30.5	205	30
October	30.0	250	70	31.0	320	100	37.1	380	280	31.0	300	140	31.4	290	110	31.2	230	70
November	30.0	270	40	32.0	250	100	38.1	410	340	31.5	260	150	31.2	300	100	31.2	250	60
December	31.0	270	75	31.0	300	90	37.0	400	310	31.2	300	165	31.0	290	95	30.4	220	50
1883.																		
January	31.0	250	70	31.0	310	90	35.2	380	300	30.2	260	130	30.1	280	45	30.1	230	45
February	31.2	270	110	31.2	320	230	36.0	370	300	30.5	240	90	30.0	270	50	30.1	210	30
March	32.3	280	140	33.6	310	270	45.7	390	330	31.5	270	150	30.3	290	50	30.3	220	50
April	33.7	290	150	35.0	310	280	44.0	370	330	32.2	320	200	30.0	230	50	30.0	220	20
May	33.2	280	140	36.3	330	280	46.0	380	330	32.3	300	170	30.3	290	150	32.4	240	80
June	32.5	290	130	34.2	330	280	45.0	390	330	33.4	310	170	31.0	310	130	33.0	240	90

The least depth through the jetties June 27, 1883, was 31 feet; the last width of the 30-foot channel was 90 feet, and the least width of the 26-foot channel was 240 feet. The length of the jetty channel is 2.22 miles, and of this length there are 1.25 miles which has a greater depth than 40 feet.

In the month of July, 1882, there were nine days during which the channel at two localities had a less depth and width than required (see Appendix A, certificate dated September 9), but it was soon restored by the aid of dredging, and has gradually improved accordingly as the inner jetty has been built.

The following table gives the minimum depths of channel through the jetties at various dates since the commencement of the works of improvement, and serves to show the progressive channel improvement from that time to the present.

Table giving the depths of water through the jetties at various dates.

Date.	Distances from East Point, in feet.					
	0 to 2,000.	2,000 to 4,000.	4,000 to 6,000.	6,000 to 8,000.	8,000 to 10,000.	10,000 to 12,000.
1875.						
June	22.5	18.7	16.7	10.2	9.7	9.2
1876.						
May	23.3	20.3	22.0	21.0	17.1	15.0
August	23.5	19.6	21.0	23.5	23.0	19.8
November	22.0	20.3	21.1	21.2	21.1	20.3
1877.						
March	24.1	21.1	23.2	22.0	21.2	20.5
July	24.9	24.0	26.0	23.8	23.5	20.3
October 25 to December 14	26.3	24.4	28.5	24.2	23.0	23.7
1878.						
March	26.0	25.9	35.5	25.4	24.3	23.0
December	28.4	26.4	35.7	27.1	25.3	23.0
1879.						
March	28.6	27.5	43.4	27.0	27.0	27.0
June	27.5	28.4	47.7	29.2	29.2	28.0
July 8	30.5	30.7	.....	31.0	30.7	30.5
December	31.0	31.0	48.3	31.7	31.8	30.8
1880.						
June	31.0	32.5	47.8	31.4	35.1	32.0
July	30.5	31.0	44.0	30.8	31.5	30.5
August	30.5	30.4	46.0	32.0	32.0	30.5
September	30.7	31.0	44.4	30.6	32.0	31.0
October	31.0	31.5	41.0	30.3	31.0	30.5
November	30.6	31.0	40.3	30.8	30.9	30.5
December	30.9	30.6	43.0	30.8	31.0	30.3
1881.						
January	30.5	30.4	41.9	33.8	30.7	30.3
February	30.4	30.2	41.6	32.0	31.0	30.0
March	31.5	31.2	41.3	32.0	32.0	30.5
April	30.4	30.0	43.0	33.0	33.0	30.5
May	30.2	30.5	42.7	32.6	30.5	31.2
June	30.0	30.5	43.8	32.0	31.7	31.7
July	31.0	32.0	42.5	33.5	33.0	32.0
August	30.1	32.0	37.6	32.0	31.0	30.2
October	30.2	30.3	38.3	31.4	31.2	30.3
November	30.8	31.8	39.2	30.4	30.0	30.1
December	30.2	31.8	39.4	30.8	30.2	30.0
1882.						
January	30.5	30.4	41.3	31.1	30.2	30.2
February	31.8	33.0	39.7	30.5	30.8	30.7
March	31.2	30.6	39.2	30.8	31.6	32.5
April	31.7	32.6	39.6	30.5	30.3	33.0
May	30.5	33.5	39.4	31.0	31.3	31.0
June	30.8	35.5	39.0	31.2	31.3	31.0
July	30.0	32.7	38.7	30.6	31.3	31.5
August	30.3	32.2	38.1	31.8	31.8	30.5
September	30.1	31.5	38.3	31.9	30.8	30.5
October	30.0	31.0	37.1	31.0	31.4	31.2
November	30.0	32.0	38.1	31.5	31.2	31.2
December	31.0	31.0	37.0	31.2	31.0	30.4
1883.						
January	31.0	31.0	35.2	30.2	30.1	30.1
February	31.2	31.2	36.0	30.5	30.0	30.1
March	32.3	33.6	45.7	31.5	30.3	30.3
April	33.7	35.0	44.0	32.2	30.0	30.0
May	33.2	36.3	46.0	32.3	30.3	32.4
June	32.5	34.2	45.0	33.4	31.0	33.0

At the locality 3,550 feet below East Point, the greatest depth is now 73 feet where here was 98 feet one year ago; a decrease of 25 feet in depth during the year. Shoaling at this locality known "the deep hole" will probably continue for some time, since the inner jetty not being built there, leaves it a wide section. (See Chart No. 1.)

The mud-lump which I reported last year as being 800 feet in advance of the west jetty, and projecting 1 foot above the surface of the water, is now 4 feet below the surface; and, another one has appeared 1,140 feet west of the west jetty, on a line joining the ends of the jetties; its highest point is about 5 feet above the surface of the water at low tide, and the lump covers an area of about 15 feet square. Its location is shown on Chart Number 2.

The depth of water over the shoal area east of the east jetty has increased about 1 foot during the year; and "base line reef" has receded about 300 feet. The depth west of the west jetty has decreased, and two reefs have formed where there was a depth of 3 feet last year.

SURVEY BEYOND THE ENDS OF THE JETTIES.

This survey comprises an area containing a fraction more than 2 square miles, the outer limit being a little more than one mile beyond the ends of the jetties, or, out to 100-foot depth.

By reference to Plate I, the note on which fully explains the results thereon, it will be seen that all the curves except those designating 40 and 50-foot depths have advanced during the year, though the change in any curve when taken as a whole is but slight; this indicates, therefore, but little change in the depth over this area during the year.

On Plate II may be seen the results of comparisons between 1876 and 1883, which show that with the exception of the central portions of the 30 and 50 foot curves, and the eastern portion of the 20 and 30-foot curves all have advanced; but, from the results as shown on No. 2 of this plate we see that when the whole curve is considered there has been an advance of all the curves, being least for that designating 20-foot depth and greatest for that designating 90-foot depth.

Now, by considering the twenty-one subdivisions of an area containing 1¼ square miles, by obtaining the mean depth of each division, and of the whole area, we may then note the localities where the greatest and least change has taken place.

The following table gives the results of these determinations and comparisons at different dates, in detail:

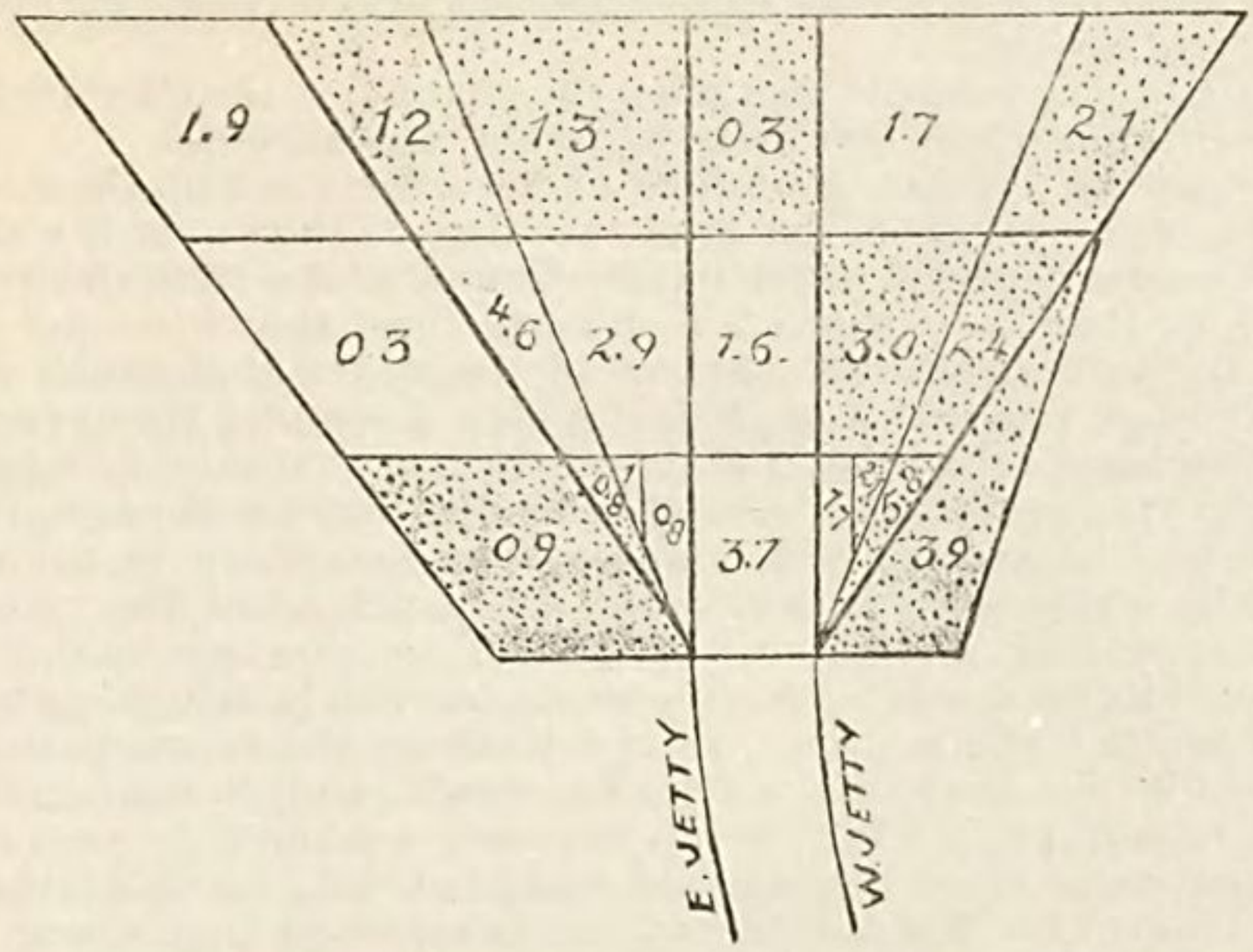
No. of subdivision.	Area of subdivision in square feet.	Mean depth of subdivision, in feet.								Quantity of water overlying subdivision, in cubic yards.								Mean depth over whole area.	
		1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	Date.	Mean depth.
1	3, 359, 484	98. 0	86. 3	93. 13	89. 47	93. 87	88. 68	86. 84	88. 70	12, 193, 680	10, 737, 893	11, 712, 156	11, 133, 335	11, 680, 428	11, 033, 790	10, 805, 592	11, 036, 526	June, 1876	60. 78
2	1, 951, 904	73. 0	76. 43	78. 12	71. 79	70. 05	70. 50	69. 82	68. 65	5, 277, 360	5, 525, 320	5, 647, 511	5, 190, 423	5, 664, 106	5, 097, 072	5, 047, 191	4, 962, 679		
3	3, 203, 900	72. 524	73. 458	72. 38	69. 32	67. 91	70. 11	68. 02	66. 69	8, 606, 200	8, 716, 392	8, 588, 820	8, 225, 954	8, 058, 639	8, 319, 105	8, 071, 693	7, 914, 463		
4	1, 771, 511	67. 455	67. 877	66. 40	61. 32	61. 92	63. 46	60. 47	60. 05	4, 425, 860	4, 453, 514	4, 356, 630	4, 023, 625	4, 062, 665	4, 163, 967	3, 961, 162	3, 939, 772	June, 1877	60. 38
5	3, 195, 900	75. 342	73. 319	77. 60	74. 26	76. 47	72. 21	71. 52	73. 18	8, 917, 980	8, 678, 488	9, 185, 253	8, 789, 980	9, 051, 617	8, 547, 376	8, 465, 109	8, 661, 835		
6	1, 951, 904	76. 724	81. 0	75. 34	74. 12	75. 57	71. 81	72. 82	70. 70	5, 546, 570	5, 855, 700	5, 446, 535	5, 358, 410	5, 463, 379	5, 191, 196	5, 264, 429	5, 111, 096		
7	3, 146, 568	63. 63	62. 45	66. 38	62. 66	63. 57	59. 82	56. 25	56. 56	7, 415, 403	7, 277, 886	7, 735, 899	7, 303, 062	7, 408, 419	6, 971, 623	6, 554, 878	6, 591, 477	July, 1878	62. 18
8	1, 177, 965	58. 40	59. 50	59. 74	58. 30	58. 62	53. 23	52. 41	56. 99	2, 547, 905	2, 595, 882	2, 606, 356	2, 543, 532	2, 557, 449	2, 322, 466	2, 286, 779	2, 486, 597		
9	1, 911, 590	53. 7826	53. 892	56. 30	56. 58	52. 63	50 59	50. 05	52. 92	3, 807, 800	3, 815, 012	3, 986, 015	5, 005, 839	3, 726, 397	3, 581, 962	3, 543, 659	3, 746, 503		
10	1, 804, 280	47. 9336	48. 845	51. 83	47. 70	49. 12	49. 41	45. 96	47. 54	3, 203, 170	3, 264, 076	3, 463, 548	3, 187, 621	3, 282, 921	3, 302, 099	3, 071, 285	3, 177, 069		
11	1, 910, 900	52. 4822	54. 075	56. 38	54. 54	54. 80	53. 53	50. 63	47. 60	3, 714, 380	3, 827, 022	3, 990, 242	3, 860, 303	3, 878, 490	3, 788, 890	3, 583, 220	3, 369, 129	July, 1879	59. 62
12	1, 177, 965	50. 5625	52. 144	49. 97	51. 05	50. 75	48. 35	46. 75	44. 33	2, 205, 950	2, 274, 950	2, 180, 110	2, 227, 400	2, 214, 138	2, 109, 604	2, 039, 755	1, 934, 131		
13	2, 664, 385	36. 803	38. 438	39. 57	40. 35	39. 67	36. 34	36. 99	36. 06	3, 631, 752	3, 793, 096	3, 904, 805	3, 982, 775	3, 914. 672	3, 586, 460	3, 650, 997	3, 558, 138		
14	354, 931	31. 464	37. 02	35. 00	34. 73	33. 63	32. 76	33. 47	32. 64	413, 612	486, 650	460, 095	456, 546	442, 086	440, 649	439, 983	429, 137	June, 1880	59. 74
15	196, 900	35. 20	36. 325	40. 01	40. 26	35. 26	33. 11	34. 26	35. 25	256, 699	264, 803	291, 766	293, 599	257, 159	241, 468	249, 844	257, 085		
16	395, 320	33. 377	36. 471	35. 92	39. 01	37. 43	33. 74	36. 47	37. 30	488, 689	533, 908	525, 922	571, 281	548, 133	494, 018	533, 989	546, 127		
17	1, 658, 310	29. 2805	33. 256	32. 20	33. 16	32. 64	30. 32	28. 18	31. 98	1, 798, 376	2, 042, 546	1, 977, 689	2, 036, 957	2, 004, 528	1, 862, 282	1, 730, 600	1, 964, 227	June, 1881	57. 36
18	390, 660	31. 444	32. 905	34. 00	35. 92	33. 07	29. 75	31. 22	32. 90	454, 959	476, 003	491, 942	519, 838	478, 515	430, 449	451, 762	475, 997		
19	195, 900	37. 0833	35. 1	39. 43	39. 47	37. 69	37. 17	41. 78	39. 68	269, 090	254, 585	286, 086	286, 413	273, 469	269, 696	303, 115	287, 900		
20	354, 931	35. 654	36. 85	37. 20	33. 47	32. 99	29. 62	29. 36	23. 57	468, 690	484, 415	489, 016	440, 088	433, 686	389, 439	385, 955	309, 920	June, 1882	56. 06
21	1, 942, 785	35. 012	31. 723	36. 50	30. 93	28. 17	22. 55	22. 97	19. 11	2, 519, 288	2, 282, 681	2, 626, 357	2, 225, 567	2, 027, 548	1, 622, 656	1, 653, 166	1, 375, 060		
	*34, 717, 993	1, 095. 1537	1, 107. 378	1, 134. 40	.....	.....	.....	.....	.....	78, 163, 422	77, 640, 825	79, 952, 753	76, 662, 548	76, 828. 444	73, 756, 267	72, 094, 163	72, 134, 878	June, 1883	56. 10

* Square miles, 1. 2453.

	Feet.
Mean fill over whole area from 1876 to 1877	0. 40
Mean scour over whole area from 1877 to 1878	1. 80
Mean fill over whole area from 1878 to 1879	2. 56
Mean scour over whole area from 1879 to 1880	0. 12
M an fill over w le rea from 1880 to 1881	2. 38
Mean fill over whole area from 1881 to 1882	1. 30
Mean scour over whole area from 1882 to 1883	0. 04
Mean fill over whole area from 1876 to 1883	4. 68

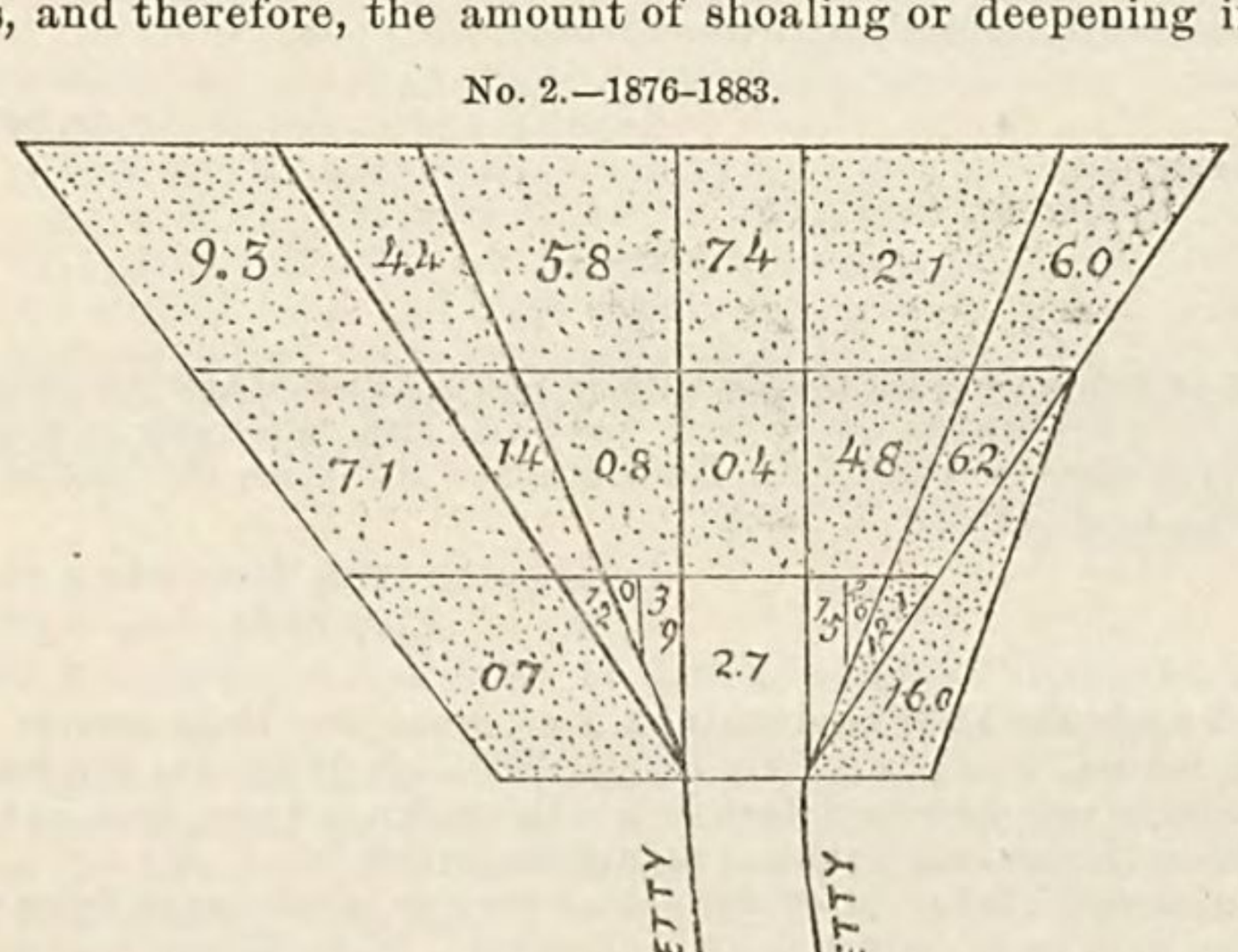
The above result confirms those given on Plates I and II, and indicates practically no change in the mean depth of this area during the year. From the accompanying

No. 1.—1882–1883.



diagrams which represent this area on on a small scale we may note the change in each subdivision. The figures express the differences between the mean depths in these divisions, and therefore, the amount of shoaling or deepening in each, during

No. 2.—1876–1883.



the period under consideration. No. 1 gives the results which are deduced by comparing the depths in 1882 with those in 1883, and No. 2, by comparing the depths in 1876 with those in 1883.

VESSELS AGROUND.

During the year I have reported the grounding of seven steamers, two ships, and one bark, at diff rent localities throughout the pass and near the ends of the jetties; of these one was grounded above Goat Island, one near Bayou Grande, one near △ Upper Base, one opposite the hotel at Port Eads, two near the wing-dam at the end of the east jetty, one near the wing-dam at the end of the west jetty, one on the lump in front of the jetties, and two were on the shoal area westward of a line which is the prolongation of the west jetty. But one of these vessels was drawing more than 24 feet. Various reasons were given by the pilots of these vessels for their grounding, "she steered badly, she took a sheer, it was foggy," &c., though in but one case did they claim that there was not water enough in the channel. I have carefully located every vessel while aground and sounded the channel, and have never failed to find a sufficient and the required depth and width of channel.

But two of these vessels were seriously delayed on their voyage in consequence of their being aground; the steamer Ashburne was aground near Grande Bayou ten

days and was delayed fifteen days; the steamer City of Lincoln was aground twenty-seven days and was delayed on her voyage seven weeks and four days.

The grounding of this latter vessel has been the subject of so much comment, and such gross misstatements have been made regarding the depth of water in the channel at the time she grounded, that I have deemed best to make mention of it in this report.

On Chart No. 6 is given a sketch showing the channel at the time she grounded; also, showing her position at three localities while she was aground.

This vessel, drawing 25½ feet, grounded about 6.30 o'clock on the morning of March 18; her position, as determined the next morning, is shown on the sketch above referred to. The actual depth of water in the channel at the time she grounded was not less than 30 feet; that is, it was 1.7 feet more than shown on my chart, since the high stage of the river made the surface of the water that much above reference plane, and the 26-foot channel was 330 feet wide. I sounded the channel twenty-four hours after the steamer grounded, and found the least actual depth to be 31 feet.

The channel at this locality, as indicated by the arrows, changes from the east to the west shore, and in making the crossing from one shore to the other pilots are usually guided by a cypress tree (marked A on sketch), but the pilot of this vessel mistook a tree, or, rather, a clump of bushes at B for this tree, and directed the vessel accordingly, thus taking her over the point marked C, which is about the locality where she first touched the bottom. In her position the current offered such resistance that she could not be pulled off by tow-boats, and, in consequence, had to be lightened; but in doing this she was not securely anchored to prevent her moving down into shoaler water accordingly as she was lightered; for this reason she remained aground much longer than she would had this precaution been taken.

I am indebted to Assistant Engineer Thomas L. Raymond for his assistance up to November 18, and to Recorder G. W. Lawes for efficient services throughout the year.

Very respectfully, your obedient servant,

C. DONOVAN,
Assistant Engineer.

Capt. W. H. HEUER,
Corps of Engineers, U. S. A

A.

UNITED STATES INSPECTING OFFICER'S CERTIFICATES FOR MAINTENANCE OF CHANNEL AT THE MOUTH AND HEAD OF SOUTH PASS OF THE MISSISSIPPI RIVER, AND ALSO THROUGH "THE PASS ITSELF," AS DESIGNATED BY ACTS OF CONGRESS APPROVED MARCH 3, 1875, AND MARCH 3, 1879.

UNITED STATES ENGINEER OFFICE,
Port Eads, La., September 9, 1882.

I certify that between the dates of May 14, 1882, and September 9, 1882, both dates inclusive, Mr. James B. Eads maintained a channel *for three months* "through the jetties" at the mouth of South Pass of the Mississippi River, "twenty-six feet in depth, not less than two hundred feet in width at the bottom, and having through it a central depth of thirty feet without regard to width."

During the aforesaid interval of time there were *twenty-seven* days when a failure occurred in some part to maintain such a channel. This failure was as follows:

For thirteen days (from May 23 to June 4, inclusive) the 26-foot channel beyond the ends of the jetties was less than 200 feet in width, during *seven* days of which time the obstruction was a small lump, probably not more than 10 or 15 feet square in area.

For five days (from June 21 to June 25, inclusive) the 26-foot channel directly between the ends of the jetties was less than 200 feet in width.

For nine days (from July 22 to July 30, inclusive) the 26-foot channel directly between the ends of the jetties was less than 200 feet in width, and from July 24 to July 28, inclusive, "a central depth of thirty feet" did not obtain in four places, the aggregate length of which was 320 feet, and included in the first 1,000 feet in length of channel below East Point.

From May 14, 1882, to September 9, 1882, both dates inclusive, a channel having "a navigable depth of twenty-six feet" was maintained through the shoal at the head of South Pass, and "through the pass itself."

W. H. HEUER,
Captain of Engineers.

UNITED STATES ENGINEER OFFICE,
New Orleans, La., January 12, 1883.

I certify that between the dates of September 10, 1882, and January 12, 1883, both dates inclusive, Mr. James B. Eads maintained "a channel through the jetties" at the mouth

of South Pass of the Mississippi River "twenty-six feet in depth, not less than two hundred feet in width at the bottom, and having through it a central depth of thirty feet without regard to width."

Also, that during the above-mentioned period a channel having "a navigable depth of twenty-six feet" was maintained through the shoal at the head of South Pass.

Depths were measured at "average flood tide."

W. H. HEUER,
Captain of Engineers.

CERTIFICATE REGARDING THE DEPTH OF WATER "THROUGH THE PASS ITSELF.

I certify that between the dates of September 10, 1882, and September 20, 1882, both dates inclusive (being eleven days), and from September 29, 1882, to November 16, 1882, both dates inclusive (being forty-nine days), also from December 13, 1882, to January 12, 1883, both dates inclusive (being thirty-one days), "a channel having a navigable depth of twenty-six feet" was maintained "through the pass itself"; but from September 21, 1882, to September 28, 1882, both dates inclusive (bing eight days), and from November 17, 1882, to December 12, 1882, both dates inclusive (being twenty-six days), such navigable depth did not exist at a point $1\frac{3}{8}$ miles below Head of Passes Light-House, when depths are reduced to a plane (the standard) indicated by a reading of 1.8 feet on gauge at Head of Passes Light-House.

From September 21, 1882, to September 28, 1882, both dates inclusive, the least depth at the locality above mentioned was 25.4 feet, and the distance over which "a navigable depth of twenty-six feet" did not exist was 500 feet.

From November 17, 1882, to December 12, 1882, both dates inclusive, the least depth was 25.9 feet, and the distance over which "a navigable depth of twenty-six feet" did not exist was 250 feet.

If the plane of the river's surface at the time the soundings were made be used, then the least depths would be less than those above given, for at such time said plane was below the one to which depths were reduced.

If depths be reduced to a plane (recommended by the Board of Engineers appointed by S. O. 229, Hq. A., A. G. O., November 2, 1876), which is "the mean of the high waters of the river at this place taken for one or more lunations when the river is at what is known as its low stage," then the least depth would be 26 feet, and the least width of the 26-foot channel 70 feet, from September 21 to 28, inclusive; and from November 17 to December 12, inclusive, the least depth would be 26.5, and the least width of the 26-foot channel would be 100 feet.

W. H. HEUER,
Captain of Engineers.

UNITED STATES ENGINEER OFFICE,
Port Eads, La., March 9, 1883.

I certify that between the dates of December 10, 1882, and March 9, 1883, both dates inclusive, Mr. James B. Eads maintained "a channel through the jetties" at the mouth of South Pass of the Mississippi River "26 feet in depth, not less than 200 feet in width at the bottom, and having through it a central depth of 30 feet without regard to width."

Also, that during the above-mentioned period a channel having "a navigable depth of 26 feet" was maintained through the shoal at the head of South Pass, and "through the pass itself."

Depths were measured at "average flood tide."

W. H. HEUER,
Captain of Engineers.

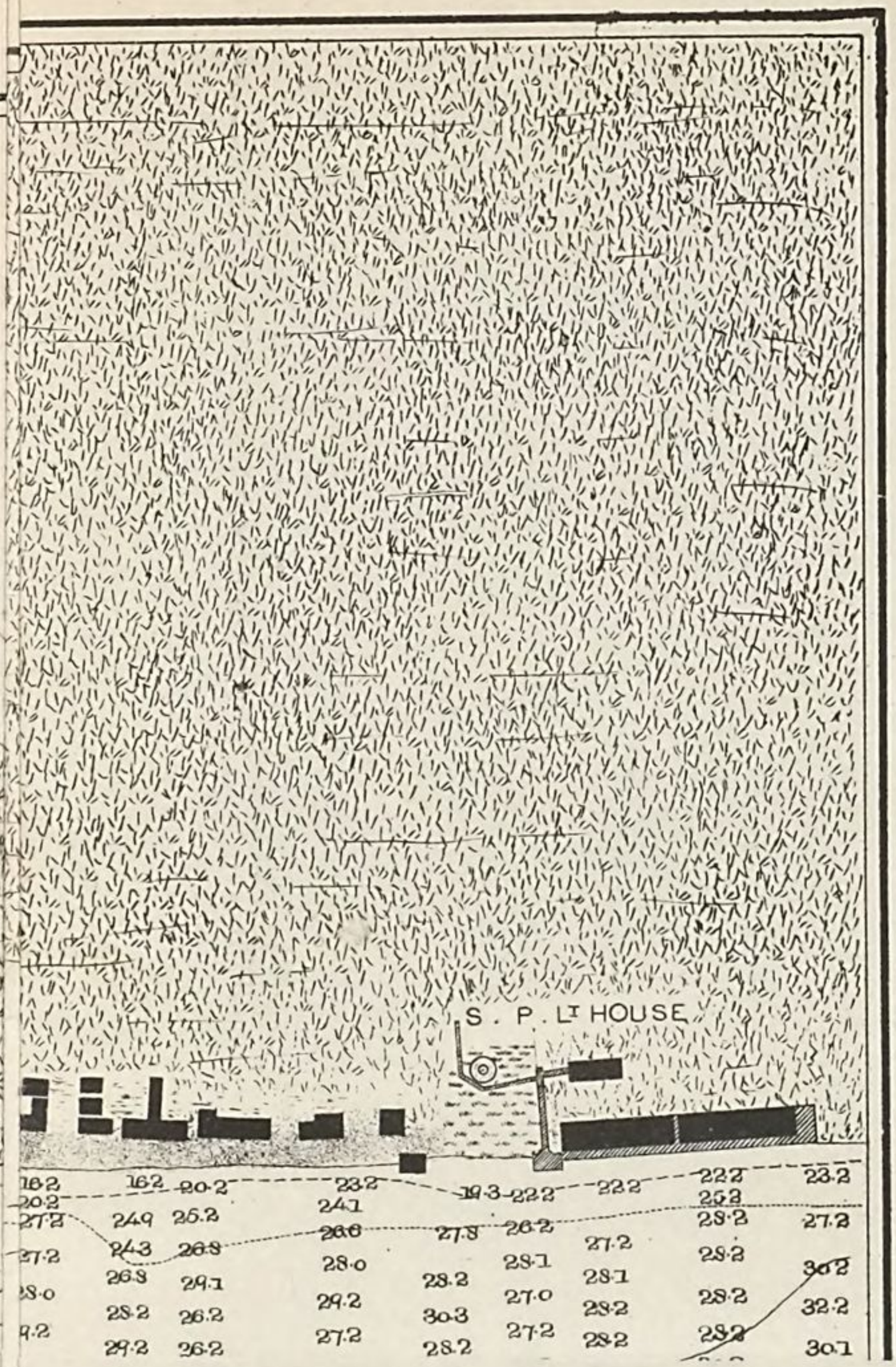
UNITED STATES ENGINEER OFFICE,
Port Eads, La., June 9, 1883.

I certify that between the dates of March 10, 1883, and June 9, 1883, both dates inclusive, Mr. James B. Eads maintained "a channel through the jetties" at the mouth of South Pass of the Mississippi River "26 feet in depth, not less than 200 feet in width at the bottom, and having through it a central depth of 30 feet without regard to width."

Also, that during the above-mentioned period a channel having "a navigable depth of 26 feet" was maintained through the shoal at the head of South Pass, and "through the pass itself."

Depths were measured at "average flood tide."

W. H. HEUER,
Captain of Engineers.


S. P. Lt HOUSE
16·2
16·2
20·2
23·2
19·3
22·2
22·2
22·2
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24·1
25·2
27·2
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28·0
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26·8
29·1
28·2
28·1
30·2
28·0
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New Orleans La. July 23d 1883
Forwarded to the Chief of Engineers, U.S.A.
with annual report for the year ending June 30th 1883.
M.T. Reeves
Captain of Engineers, U.S.A.

Note.
Depths are expressed in feet and tenths of a foot and refer to the plane of average flood tide indicated by a reading of 2.76 feet on U.S Engineer's gauge at South Pass Light House.
Soundings taken June 14th, 15th, 19th and 20th 1883.
Carrollton gauge reading 12.5 feet.

Scale

△ East Lump

Nor. Lump
6ft above low water

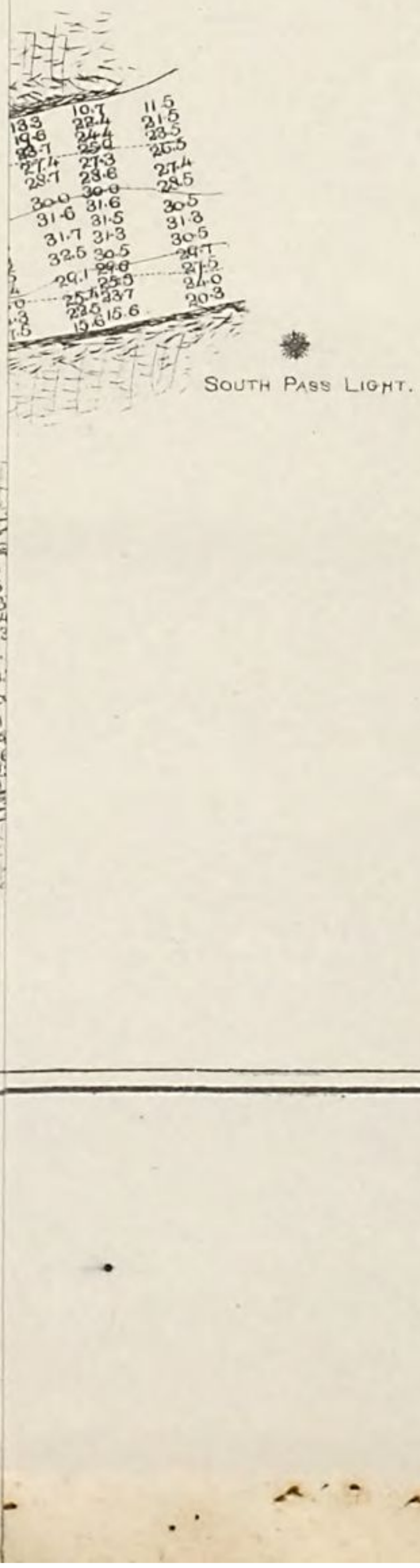
East Jetty

West Jetty

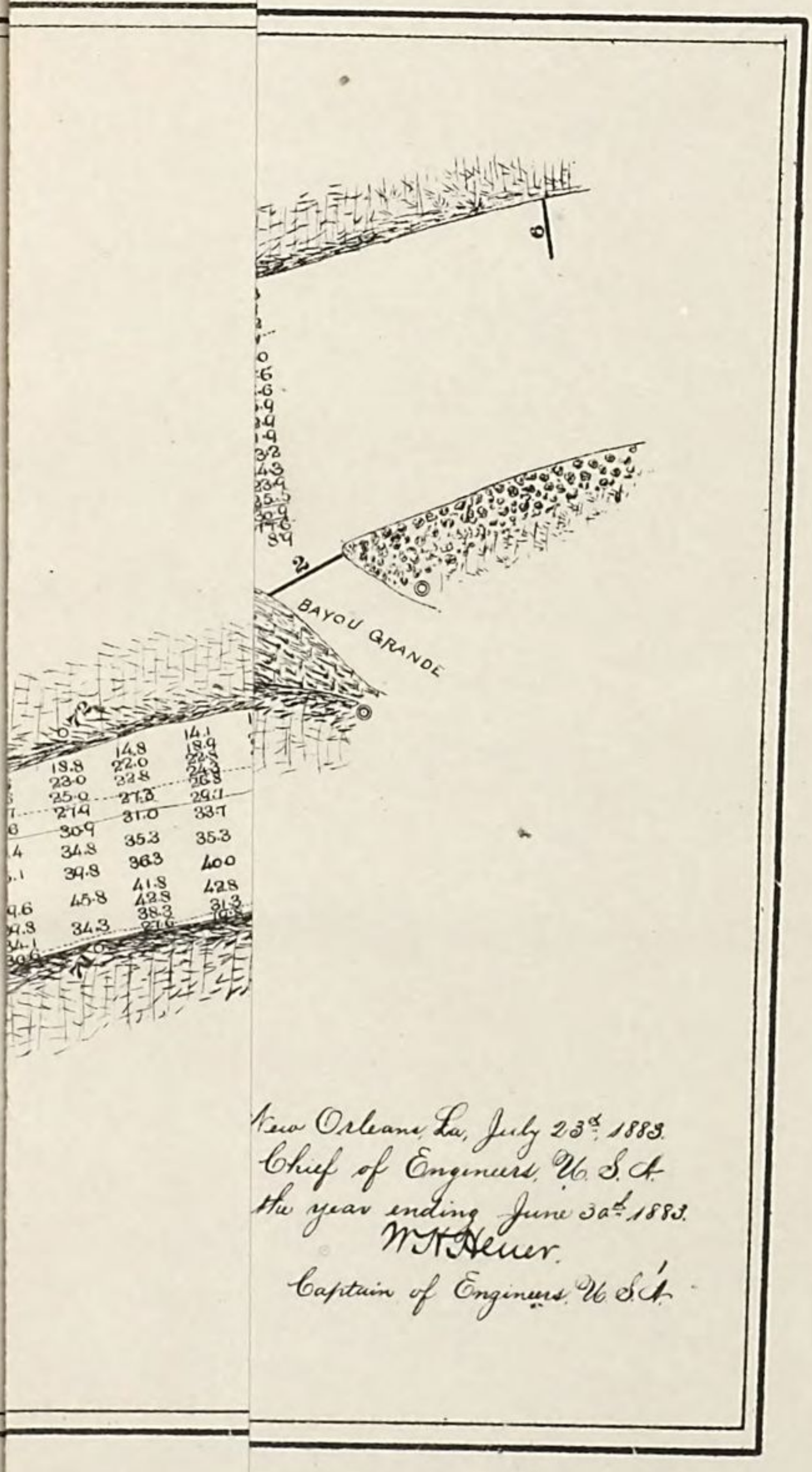
True Meridian

No 2.
CHART
OF A PART OF
GULF OF MEXICO,
SEAWARD FROM THE ENDS OF
SOUTH PASS JETTIES,
TO A DEPTH OF 100 FEET.
Surveyed and Plotted
BY
C. Donovan, Assist. Engr.

VA



SOUTH PASS LIGHT.



New Orleans La, July 23d 1883.
Chief of Engineers, U. S. A.
the year ending June 30th 1883.
W. H. Heuer.
Captain of Engineers U. S. A.

MAIN LAND

MAIN LAND

UPPER DAM

DAM No 4

DAM No 3

DAM No 5

CHANDELEUR SOUND

LIGHT HOUSE

MATTERHORN

True Meridian

Note.
Depths are expressed in feet and tenths of a foot and refer to the plane of average flood tide indicated by reading of 16 feet on U.S. Engineers gauge at Head of Passes Light House.
Soundings taken May 15th, 16th and 17th 1888.
Carrollton gauge reading 3.1 feet.

SCALE

CHART No 5.

HEAD OF PASSES

MISSISSIPPI RIVER,

Showing location of jetties, dykes, dams &c.

SURVEYED AND PLOTTED BY ORDER

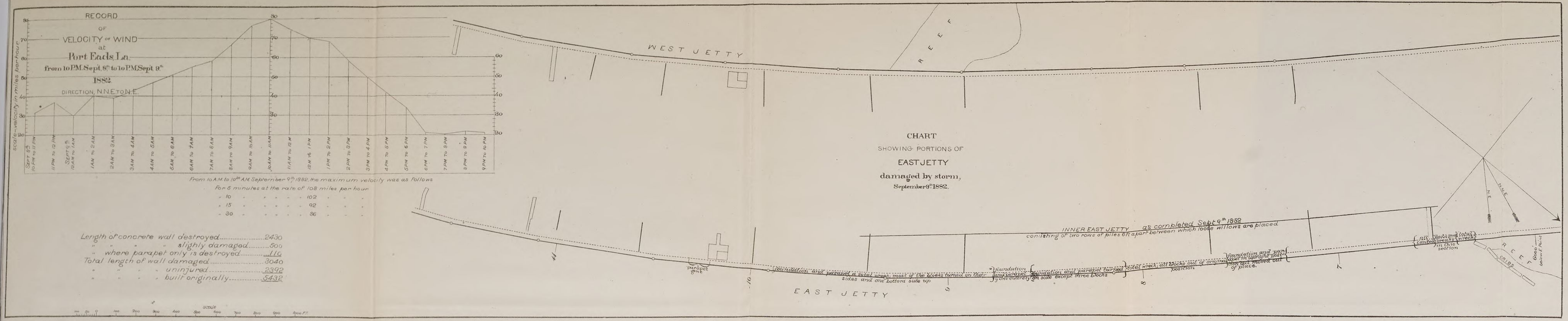
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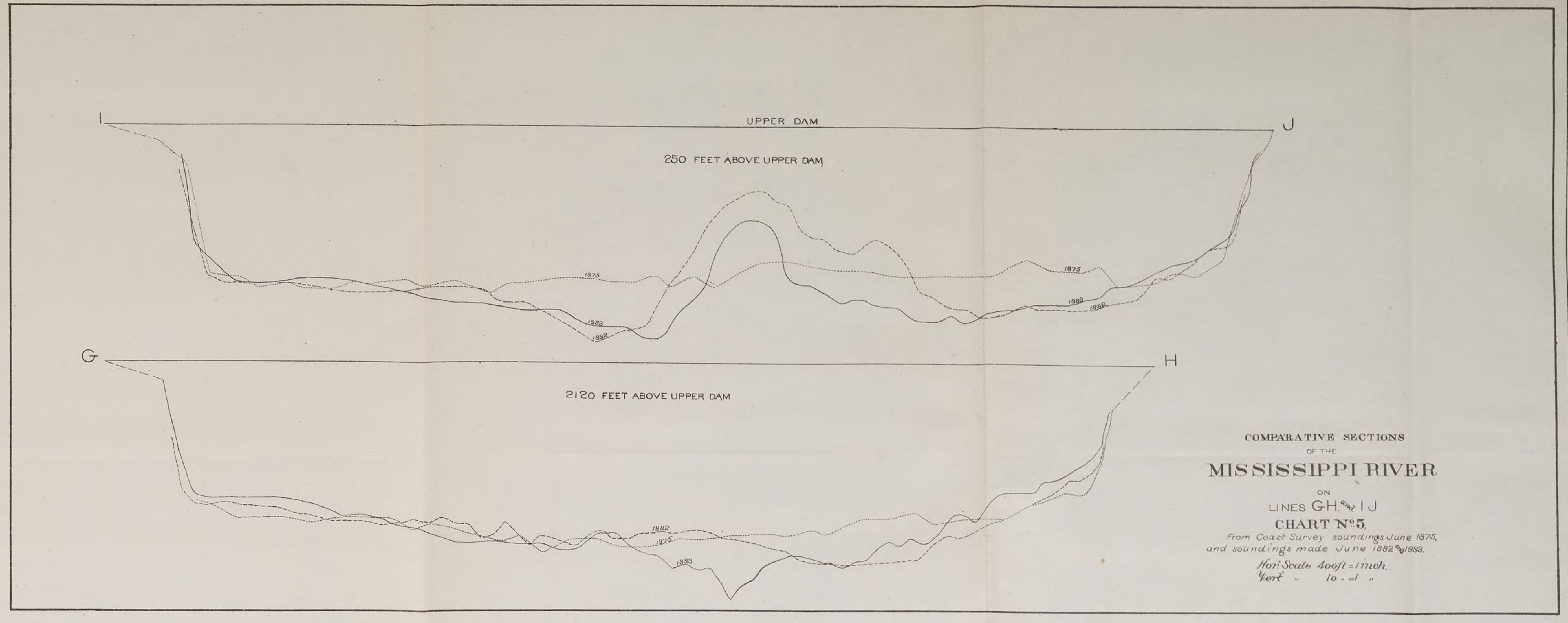
Capt. W.H.HEUER Corps of Engr's U.S.A.

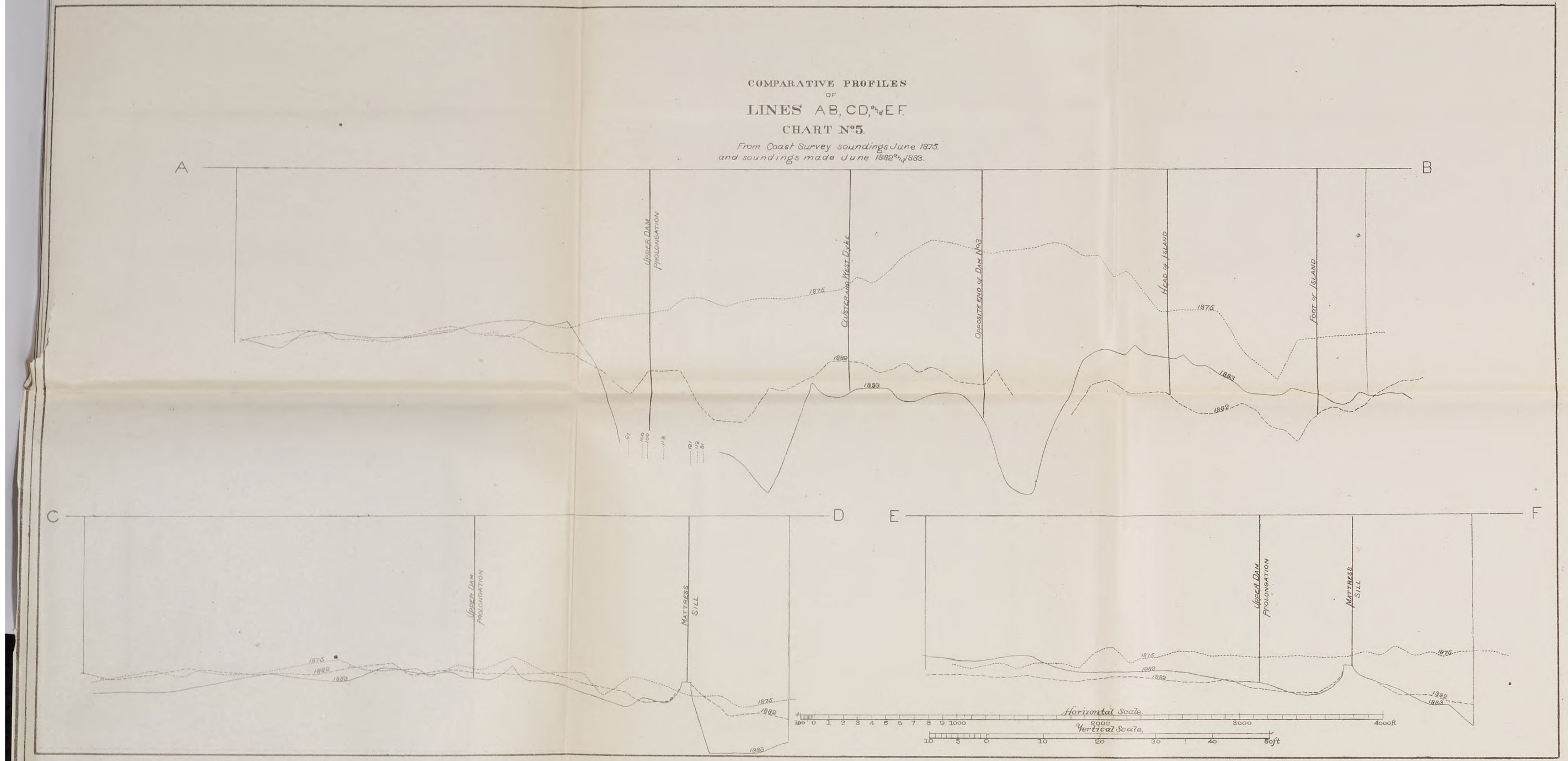
BY

C.Donovan Assistant Engineer.

New Orleans La. July 25th 1888.
Forwarded to the Chief of Engineers U.S.A.
with annual report for the year ending June 30th 1888
W.H.Heuer
Captain of Engineers U.S.A.







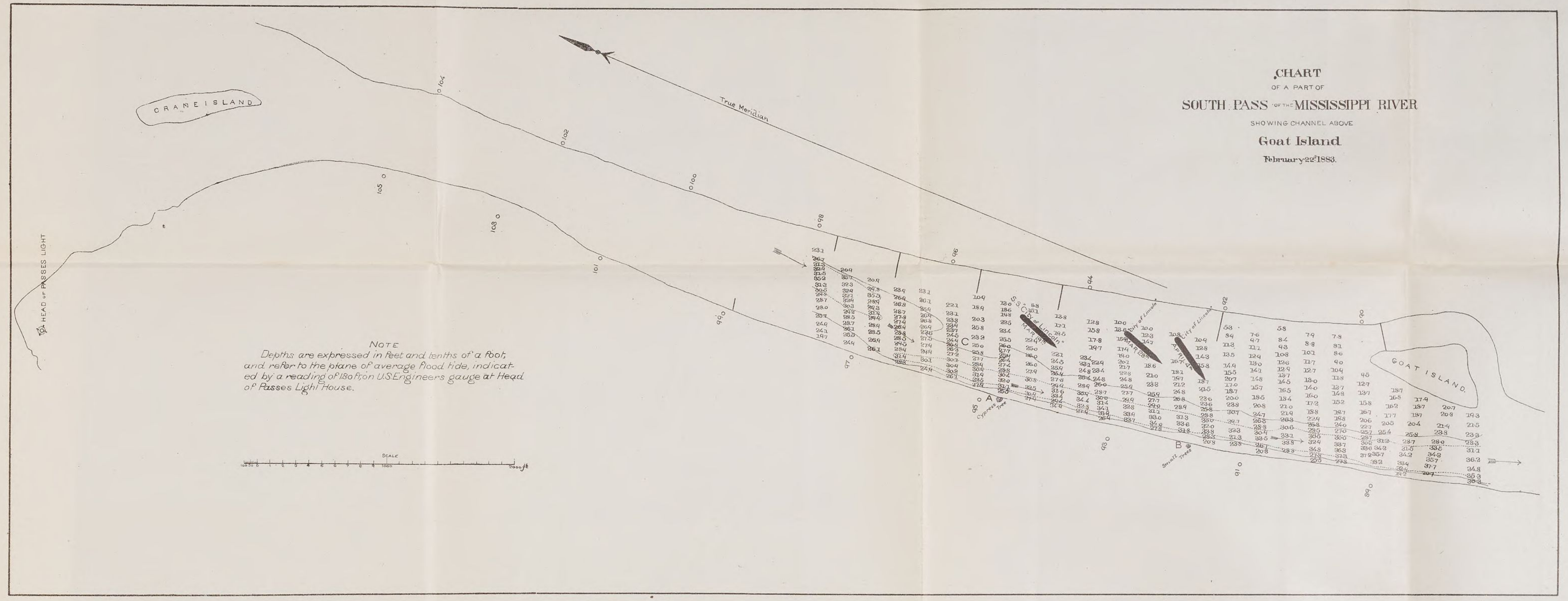


CHART No. 6
TO ACCOMPANY THE
ANNUAL REPORT
UPON THE
IMPROVEMENT OF SOUTH PASS
OF THE
MISSISSIPPI RIVER.
BY
C. DONOVAN, Asst. Engr.

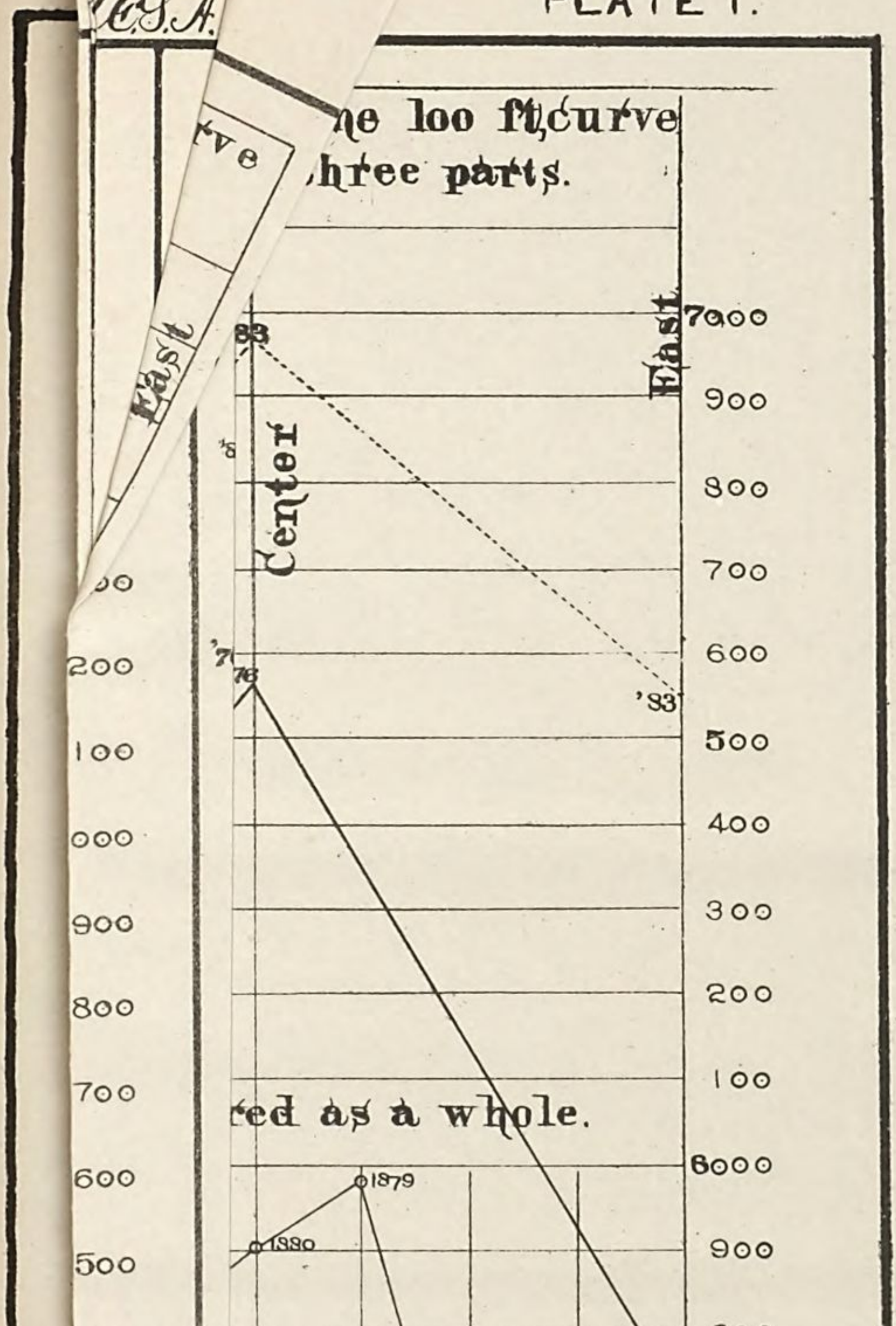
New Orleans, La., July 23d, 1883.
Forwarded to the Chief of Engineers, U.S.A.
with annual report for the year ending June 30th, 1883.
W. H. Heuer,
Captain of Engineers, U.S.A.

EAST POINT

R

Pont Rouge

PLATE I.


U.S.A.
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Diagrams

Showing the advance or recession

OF THE

Curves of various Depths,

SEAWARD FROM THE ENDS OF

South Pass Jetties,

from 1876 to 1883

COMPILED BY

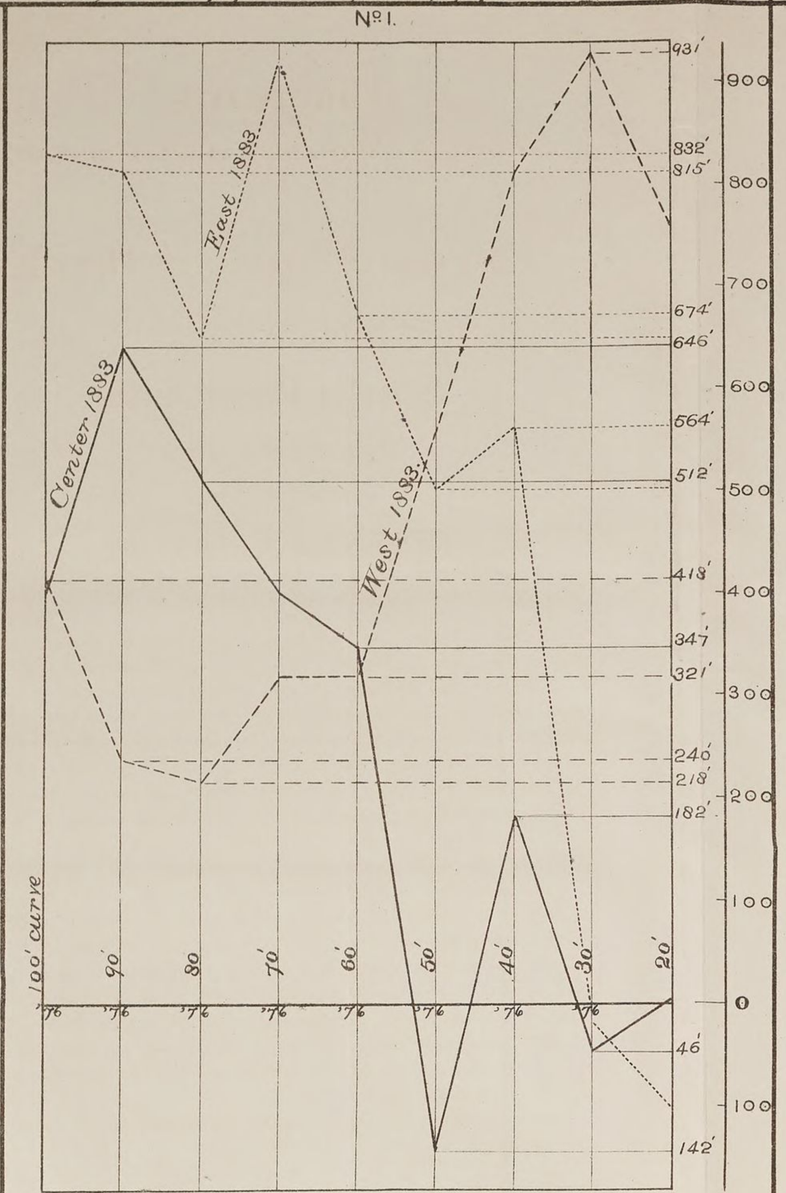
C Donovan, Assist. Engr.

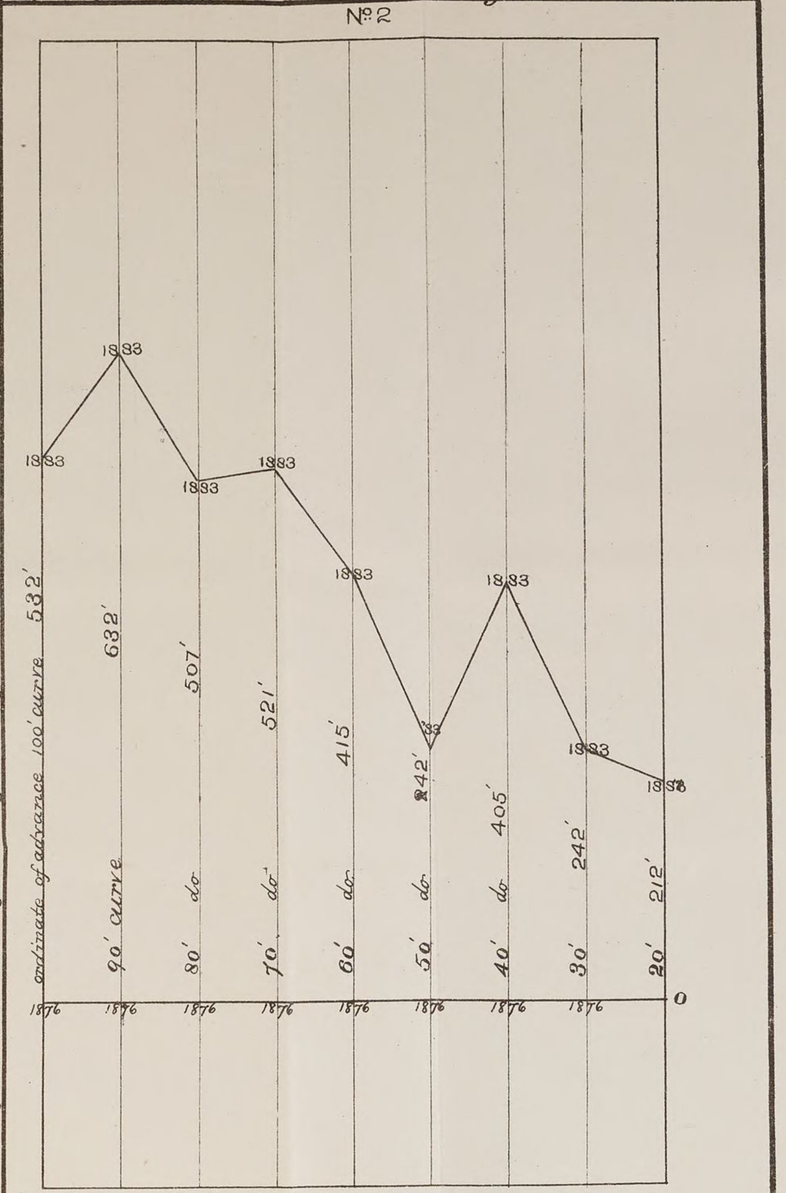
NOTE.

On these diagrams the length of each ordinate is the difference between the mean ordinate for 1876 and 1883, and therefore measures the amount of the movement of the various curves, between these two dates, and for this purpose the ordinates of the positions of these curves in 1876 are assumed to be zero; negative ordinates indicate recession and positive ones advance of the curve to which they pertain. On N°1 each curve is considered in three parts, and we may see how each part is affected; On N°2, each curve is considered as a whole.

Each ordinate is marked with the number of the curve to which it pertains and the extremeties of each ordinate by the years between which the comparisons are made, and along the axis of ordinates is given (in feet) the distance that each curve has advanced or receded, so that at a glance we may note the change in each curve from 1876 to 1883, and also the amount of the same: for example, we see from N°2 that from 1876 to 1883 the 100-foot curve advanced 532 feet.

These deductions are made from the same data as for PLATE I.





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